Clay in the Classroom

A MEANS TO CREATIVE EXPRESSION

GEORGE BARFORD

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CLAY IN THE CLASSROOM

A Means to Creative Expression

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and the author, except as noted

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Schenley High School, Pittsburgh, Pa.

Clay is one of the finest materials for education in art expression. It is inexpensive and easily available. Clay's unique quality, its wonderful plasticity, enables it to be molded into shape while moist and the material will retain the same shape when dried and fired. It is the plastic quality that makes clay so appealing to students of all ages and provides its chief value as an art medium in the classroom. The *direct* manipulation of the material, its quick response to the touch and the possibilities of working with no tools other than the hands are all factors which favor the use of clay as a means, leading toward a greater understanding of individual creative expression.

This book is directed to classroom teachers who want to include ceramics in their curricula. Some teachers, including those who "inherit" rooms equipped with clay and small kilns, are often reluctant to offer problems to be worked out in clay, fearing that they, themselves, are not thoroughly grounded in ceramics. One purpose of this volume is to help dispel concepts of mystery which may surround the art. Equipment, procedures and methods, which can be elaborate and complex, have been adapted here to classroom situations. The major portion of the text is applicable to the elementary level, although some suggestions are suitable for working with older students in art classes.

Edited by Dorothy W. Perkins, Ph.D.
Ceramic Department
Rhode Island School of Design
Providence, Rhode Island

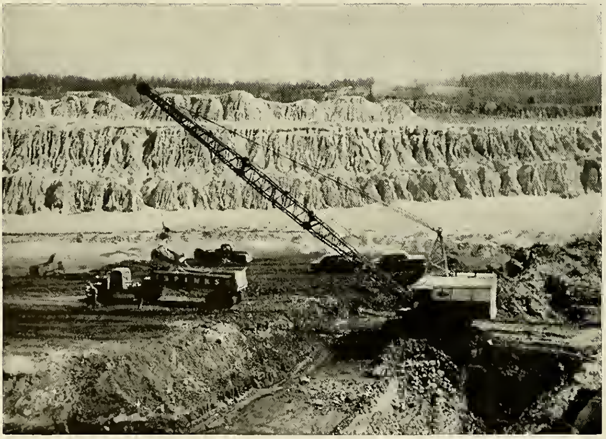
CLAY

Courtesy Board of Education, New York City

CLAY is found practically everywhere. Unless one lives on a beach or in a desert, clay in one's backyard, under the topsoil, is probable and its quality doubtlessly would be such that it could be used for pottery. Large, commercially valuable deposits of clay are found in Ohio, Tennessee, Florida, Illinois and California, among others. Many clays can be used singly, before or after washing, screening and stiffening, to make pottery. Others, which may not, individually, provide the particular qualities desired as to fired color, temperature and workability, can be combined with other clays and inorganic materials to form clay bodies. The "clay" from which porcelain dinnerware, for example, is made is not a single clay but a body compounded of a white clay, for color; a very plastic clay, for workability; a flux, for fired density; and silica, for fired hardness and glaze fit.

The mineral, clay, is formed by the gradual erosion of rocks over periods of thousands of years. Water washes the disintegrated rock, altering both its chemical and physical properties and carries it over the surface of the earth. Clays are frequently found, therefore, along stream or river beds. Some clay deposits, however, are hundreds of feet underground, having been formed at a time when those areas were exposed.

Clay is composed of aluminum and silicon oxides, water and, often, impurities such as iron oxide. The physical properties of clays vary, determined in great part by the extent of their individual travels over the earth's surface. The longer the trip, the finer the degree to which the particles are worn down, the greater the deterioration of organic matter mixed with the clay and the more plastic the clay.



Clay is mined, industrially, by stripping away the overburden of soil, rocks and trees. Power shovels are then used to remove the clay, as in this mine in western Tennessee. Photo courtesy H. C. Spinks Clay Company.

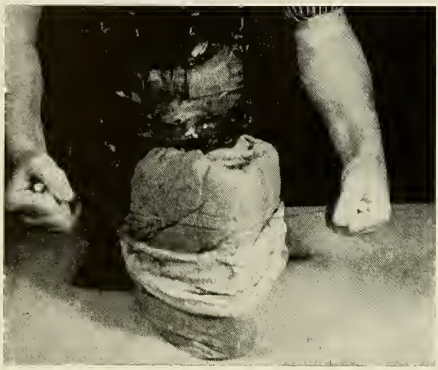
Courtesy Chicago Natural History Museum

The plasticity of clay and its enduring hardness after firing led to its appreciation by early man. The Babylonian vase, from Kish, is about 4000 years old. Archaeologists find, in fired clay, the chief indestructible material through which they can trace the history of ancient civilizations. Five thousand years ago, Egyptian clay workers manufactured bricks and pipes, jars and bowls and other products for daily use. Except for improvements in the mass production of clay forms, the basic nature of clay manufacturing has changed very little.

In modern times, clay is used to make pottery, bricks, tiles, dinnerware, sculpture, firebrick and sanitary fixtures. It is also used in the manufacture of face powder, paints, paper, linoleum and rubber products. Clay touches the lives of all. One of the happiest ways in which it can become a part of life is as a material for individual form expression, making it a valuable medium for art education.

PURCHASING CLAY Clay can be purchased from ceramic suppliers in either the moist, "plastic", form or in dry, powdered form. Purchasing the moist form is most practical for classroom use unless the amount of clay required is very substantial. It can be ordered in quantities from five to five-hundred pounds: the price usually drops as the quantity ordered increases.

Many teachers order moist clay in hundred-pound cartons. The clay is packed in the carton in four moisture-proof plastic bags, each holding twenty-five pounds. These are easy to handle—a distinct advantage. Clay in unopened bags will retain its consistency indefinitely. After a bag has been opened it should be closed by taping it tightly at the top or fastened with a rubber band or spring clothespin to keep it airtight.



Clay received from the supplier in plastic bags need not be "wedged"—that is, worked to dispel air and induce an even consistency—if it is removed from the bag as illustrated above. The bag is peeled down around the clay, then the desired amount is cut off with a thin wire held horizontally. Clay is cut more easily with a wire than a knife, since it tends to stick to the sides of a knife blade.

Some companies pack and ship their moist clay in wooden or fiber tubs or barrels. If clay is received in this manner, it should be removed and placed in a plastic or galvanized metal can with a tight-fitting lid. Plastic containers cost more than metal cans of the same capacity but have the advantage of not rusting or otherwise contaminating the clay. Any reasonably airtight receptacle will keep clay moist for a long time, especially if the clay is covered with a damp cloth or wrapped with plastic within the container.

Clay in dry or powdered form is easily stored in any convenient container: can, box, bag, jar or bin. The disadvantage of purchasing clay in dry form is that it must be mixed with water and kneaded or wedged into working consistency. The advantage is that it is considerably cheaper than the moist form in which the water and the labor of working the water into the clay are part of the supplier's price. While it is true that the preparation for use of a great quantity of dry clay requires both space and some physical effort, the savings represented and the more direct experience for the students may make it desirable.

The mixing of dry clay with water may be accomplished by one of several methods. That which requires the least space and time can be done in any wide, fairly shallow container—a dishpan, for example. A layer of dry, powdered clay, about one inch deep, is put in the bottom of the pan and sprinkled liberally with water. Hot water will hasten the process. Another layer of clay is added and sprinkled. When the pan is about two-thirds full, it may be set aside for a short time to allow the clay particles to absorb water. Covering the pan with a piece of plastic will accelerate the wetting of the clay. If mixing is started at once, without the short wetting period, more difficulty will be encountered in arriving at a satisfactory mixture, without excessive "lumping."

When the clay has become rather evenly damp, it can be squeezed with the hands into some semblance of a workable mass. It should then be kneaded, just as dough is kneaded, and wedged. If the mass is quite wet, kneading it on a thick plaster slab will help to remove the excess moisture. If it is quite dry, additional water can be sprinkled on during the kneading.

TYPES OF CLAYS This world offers hundreds of kinds of clay, from that in the backyard to very special clay bodies compounded for scientific and industrial uses. One way of discussing clays and clay bodies for the classroom would be in terms of their *fired* colors. The unfired color of a clay is not necessarily an indication of its color following firing, which is—after all—the important color.

BUFF-FIRING CLAYS Although buff-firing clays have been popular for school use, because they are very plastic and often less expensive than other clays or clay bodies, few elementary or high schools have kilns capable of reaching the temperatures required (2150°F. to 2400°F.) to "mature" them—that is, make them dense and hard. When a clay is not fired to its maturing temperature, glazes do not "fit" but develop "crazing"—cracking in the fired, glassy surface. The firing of these buff-burning, essentially high-firing clays, at low temperatures has probably resulted in more disappointments to student clay workers than all the other sources of difficulty put together.

When firing facilities permit the temperatures required, buff-firing clays are extremely useful. The two principal clay types which fire buff are "stoneware clays" and "fire clays." Stoneware clays have fine working qualities: Monmouth, Jordan and Perrine are examples of this type. They are very plastic and will dry well without cracking if not too thick in cross section. Some fire clays have excellent textures and good working properties for sculpture or for coil or slab method pieces. Fire clays, from New Jersey, Ohio, Missouri and other states, may often be combined with each other or with a stoneware clay to make excellent clay bodies for modeling or throwing.

If clay work is to be fired but not glazed—as in the case of sculpture—firing the buff clays below their proper temperatures will do no harm although the clays will not achieve their best visual qualities nor will the pieces be very durable. If the work is not to be fired, these clays—or any clays, for that matter—can be used for modeling.

Peabody High School, Pittsburgh

Monnier School, Detroit, Michigan

RED-FIRING CLAYS Red-firing clays are more easily vitrified than are those which fire buff: they become hard and dense at lower temperatures because the iron oxide present acts not only as a colorant but as a "flux" (glass-former). Some red clays, when fired to Cone 04 (1940°F.), will hold water without seepage, even though no glaze covers the surface. The *unfired* color of these clays varies: it may be red-brown, yellow, greenish or grey. When fired to maturity, however, the color will be similar to that of red brick, drain tiles or flowerpots.

The greatest recommendation for red-firing clays lies in the fact that most of them can be fired to maturity in classroom kilns. These clays also produce pieces with a warmth of character not associated with buff- and white-burning clays. This quality seems appropriate to the hand-built or thrown forms of beginners; ostentation and sophistication should not be their aims.

Many red-firing clays are available commercially. They are suitable for hand-building methods and for throwing. In addition, there are those which have been compounded especially for ceramic sculpture. These bodies are sometimes listed as "Terra Cotta" or "Sculpture Clay" in suppliers' catalogs. They are usually red-firing, although some suppliers also furnish white or buff sculpture clays.

The difference between a red-firing clay and a red-firing sculpture clay is principally the presence of "grog" (clay which has been fired to a low temperature, crushed and screened). Commercial sculpture clays may contain as much as 40% grog. The grog provides five distinct advantages for sculptural forms, the first four of which relate to the fact that it "opens" the clay—that is, makes it more porous before firing. The grog permits: (1) the work to progress more rapidly because the water which makes the clay workable evaporates more readily; (2) greater variance in thicknesses of various parts of the form, with less likelihood of cracking on drying; (3) faster drying of the completed form; (4) less danger of forms cracking on firing; and (5) a textural quality that ungrogged clay does not possess.

Purchasing a special grogged body is not essential. Almost any clay or clay body can be made into a "sculpture clay" by the addition of grog, available in coarse, medium or fine grades and in white, buff or red colors. It may be added to dry pottery clay in the proportion of one part grog to two or three parts clay. *Dampened* grog may also be wedged or kneaded into clay in the moist form. Dampening the grog prevents it from drawing water from the plastic clay, which could make it too stiff for working. Grog may also be made in the classroom by the simple expedient of crushing soft insulating brick, then screening to the desired degree of fineness.

The working, drying and firing qualities of sculpture clays or grogged clays make them especially suitable for work by children, who are inclined to make forms thick in cross section or with wide variations in thicknesses. There will be less cracking if the clay contains grog.

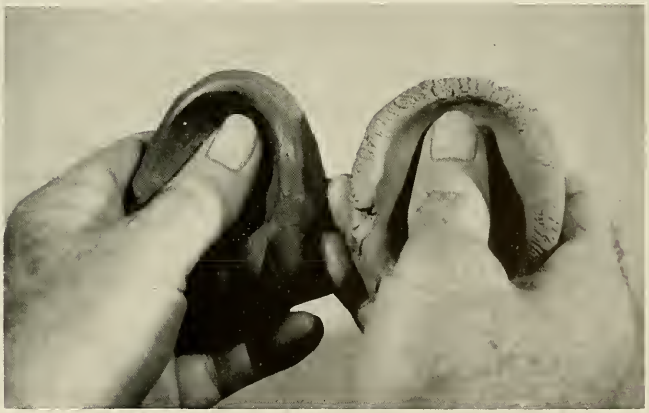
LOCAL CLAYS In addition to commercially-available red-firing clays, "local clays"—those found on or near the surface of the earth—almost invariably fire some shade of salmon to reddish-brown to brown. The pieces shown above were made of clay from an excavation for a new school. A great measure of adventure and satisfaction is to be found in digging, wedging, shaping and firing a local clay, in controlling the entire expression in terms of material and concept. A clay-hunting expedition, subtly directed to a pre-determined deposit, is a project suitable for students of all ages.

Some clays are so clean that they can be used directly as dug. Others contain small pebbles, bits of roots and twigs or sand. The easiest way to prepare these for use involves:

1. Drying the clay.
2. Crushing it to walnut-sized pieces.
3. Filling a container with hot water.
4. Adding clay until it rises above the surface of the water.
5. "Slaking"—allowing the clay to remain in the water *without* stirring, over night or longer, until each grain of clay is well saturated.

6. Pouring off the clear, extra water.
7. Stirring vigorously.
8. Screening: ordinary window screening will suffice unless large amounts of very fine sand are present.
9. Pouring the slip into dry plaster bats or onto *many* thicknesses of newspaper, either of which will absorb excess water so the clay can be handled.

Some local clays may be too "short"—not plastic enough for use. They may crack and crumble if used for hand-building methods, split and slump if used for throwing. This defect could be due to the presence of too much sand, in which case the correction lies in finer screening. If sand is not the problem, then the addition of Bentonite could be tried. Bentonite is an extremely plastic material, resulting from the disintegration of volcanic deposits. An addition of 1% to 2% by weight, well-mixed with the dry clay *before* slaking, may correct the difficulty. A further possible correction would be the addition of ball clay: this could be as high as 5% to 10%, without changing the maturing temperature or the fired color of the clay appreciably. In greater percentages, it could alter both.



CLAY CONSISTENCY is of considerable importance in working with the material. It is determined by the clay itself and by the amount of water added for workability. The clay on the left is of a good consistency for working: it is moist enough so one can model it with ordinary pressure of the fingers but not so moist that it will stick to the fingers. The clay on the right illustrates not only a clay that is too dry but one that is too "short"—not plastic enough for workability regardless of the amount of water added to it.

WHITE-FIRING CLAY BODIES Single clays which fire white are relatively non-plastic. They also require very high temperatures. Ceramic suppliers, therefore, mix the white clay or clays with the very plastic ball clays for workability. Fluxes are added to lower the firing temperature and sometimes flint, to aid in glaze fit. Thus, when "white clay" is ordered, the material received is a white clay body which will perform at the temperature stated by the supplier.

These bodies are particularly effective for jewelry and small clay forms, where brilliant glaze effects are desired. Colored slip decoration and underglaze colors will often seem to produce more intense colors on a white clay body and transparent glazes will be more brilliant in color, the body brightening them, rather than greying them as a red-firing clay would.

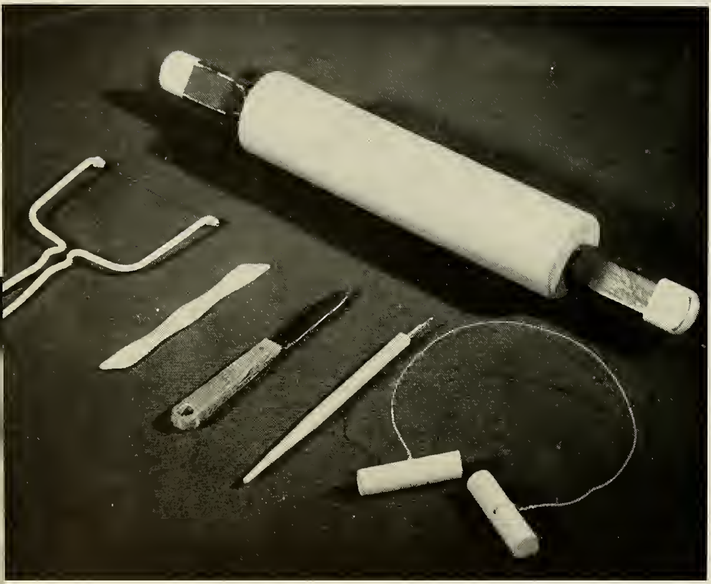
SELF-HARDENING CLAYS When a kiln is not available, the use of self-hardening clay is recommended. This is pottery clay to which has been added a chemical setting agent which causes the dried clay pieces to be several times harder and more durable than those without the setting agent. Forms made from self-hardening clay will be more resistant to breakage than other dried clays but they will *not* be watertight, as are clays fired to their proper temperatures. The principal disadvantage of introducing students to self-hardening clays is that they are misleading: impressions gained from their use—including the temptation to paint the forms with either tempera and shellac or enamel paints, by way of glazes—do little to nurture respect for the truly remarkable qualities of ceramic materials.

When clay work is to be retained indefinitely in the dried state, without firing, an addition of Dextrine to any clay (except self-hardening clays) will make the pieces much harder and less fragile than they would otherwise be. Dextrine may be purchased in drug stores in powdered form. It can be added to moist clay by rolling out the clay and sprinkling it generously over the surface, after which the slab is rolled up and wedged. Dextrine may also be added to clay when it is in the dry, powdered state, before mixing with water. Three to five percent of the weight of the dry clay may be added.

TOOLS AND MINOR EQUIPMENT

Metcalf School, Normal, Illinois

Other than clay and eager students, what tools and equipment will facilitate the mutual success of the two? A kiln represents the major item and expense. Various types of kilns are considered in the section on Kilns and Firing. Beyond the kiln, possibilities range from the most elaborate equipment to the barest minimum. Purchasing all the intriguing tools and equipment offered by ceramic suppliers, despite the ever-present desire of the teacher to do so, is not essential. If the budget allows, of course it would be convenient for each student to have a potter's "fettling" knife for his use but a not-too-sharp paring knife will perform approximately the same tasks. The resourcefulness of the teacher will play the greater part in the success of student clay workers.



Fingers are the only tools that most young children need to make objects of clay. Occasionally, however, the simple tools shown here will be helpful: the rolling pin, for making flat sheets of clay for tiles or slab-building; the cheese-cutter, for cutting through moist clay without distorting the form; the wooden modeling tool or an orange stick, for detail and scratching; the knife for cutting out tiles and general trimming of leather-hard or dry pieces; a pen-holder with a scrap of metal or a commercial sgraffito nib inserted; and a twisted wire, useful in cutting pieces from commercially-bagged clay. To these could be added natural or cellulose sponges. The former are sold as "elephant ears" by suppliers but for general classroom use the latter will suffice and are much less expensive.

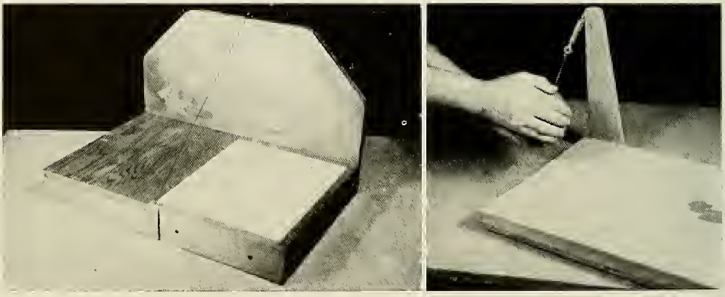
PLASTER BATS Discs of plaster, called "bats", are most helpful in working with clay in the classroom. Clay will not stick to a dry plaster surface and the work being done will stiffen as it progresses, because water will be drawn from it into the plaster. Work done on bats can also be moved from the table to storage facilities without direct handling, which could deform the soft clay pieces. The simplest way to make a group of bats is to cast plaster into paper or aluminum pie plates.

A second grader makes an animal paperweight, working with his clay on a plaster bat. Harriet Beecher Stowe School, Cincinnati. Moran Photo

When clay has been purchased for the classroom, consideration of a surface on which to "wedge" it should be made. Wedging may be done on a wedging table or wedging board. The former is a sturdy table, permanently converted to, or built for, the purpose. The latter is portable, suitable for elementary work but not for advanced students using larger masses of clay—as in throwing, for example.

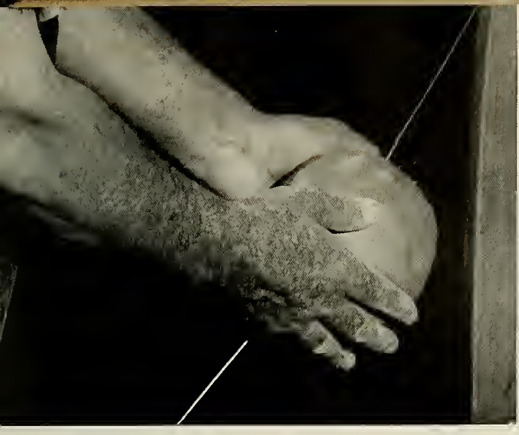
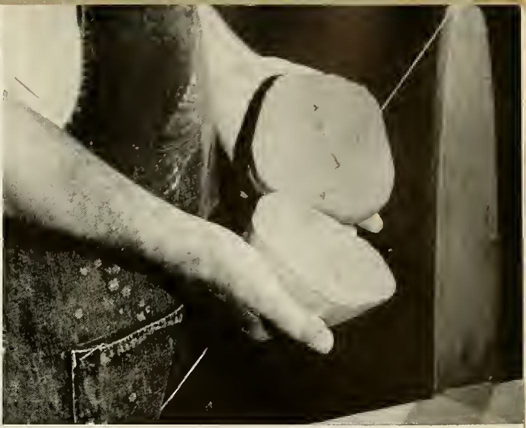
Clay can be wedged on many surfaces; plaster or canvas proves best for student use. A wedging table surfaced with plaster has several advantages over canvas alone. First, it will help to stiffen clay that is too moist, by drawing excess water from it. By virtue of the same property, it can also over-dry clay which is "just right" when wedging begins. Second, the plaster wedging table is heavier, by the weight of the plaster, than is a table merely covered with canvas. Rigidity is favorable, since the wedging process is vigorous. A standing frame may be built around the edge of a sturdy table, forming an open "box." The box may be filled with stones, a layer of chicken wire and, finally, plaster, all of which will add weight and some resiliency to the surface. A shallower box, 1½″–2″ deep, without the stones and wire, will suffice for all but the most advanced students. Since plaster surfaces eventually crack and chip, the wedging table will be further improved if canvas is put over the plaster, drawn tight, and fastened over the edges of the table.

Whether the wedging surface is of plaster or canvas, a cutting wire will be desired if wedging is to be done by the occidental method, illustrated here. The oriental method of wedging is one of kneading, rather than cutting.



Although a sturdy wedging table is convenient and necessary for advanced students, portable boards can be built or purchased. The board at the left is typical of those commercially available, with its surface divided between plaster and varnished wood.

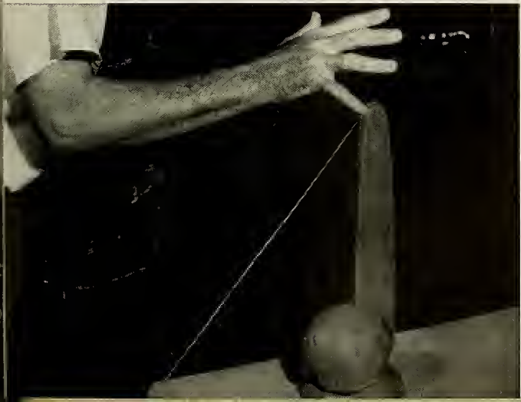
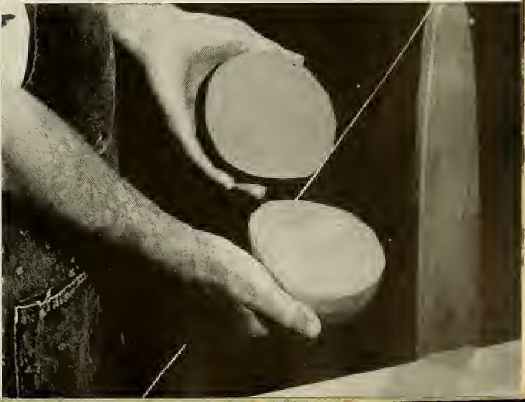
The board at the right was made from two pieces of ¾″ plywood, 16″ x 24″, screwed together to make one thick board. The top is covered with canvas, stretched over the edges and fastened securely with tacks. The upright board is attached to the back edge of the base with screws. A turnbuckle is attached to the top of the upright board and provides the means for taking the slack from the wire, which extends to a screw eye set in the front edge of the wedging board. The turnbuckle should be fully opened before stretching the wire, then it can be turned gradually until the wire is tight enough to "sing" when plucked.

WEDGING If clay objects are to be fired—and it is always to be hoped they will be—the clay should be free of entrapped air and layers of harder and softer clay. The process which eliminates these problems is known as wedging.

A lump of clay is held in both hands and cut through the wire. One half is thrown down onto the wedging surface with one hand. The second half is brought down with the other hand. Beginners are often awkward in bringing down the piece in the left hand and want to transfer it to the right hand as soon as it is empty. They should be encouraged to use both hands and, since the aim is usually better with the right hand, to throw the left-hand piece down first, then the right piece on top of it. The steps are repeated, until all entrapped air and striations have been removed.

Wedging may require only a few repetitions of the steps or it may require many, depending upon the condition of the clay and the amount of water in it. The longer the wedging continues, the drier the clay will become, so it can be too prolonged—a favorite pastime of beginners. Clay which is too soft to wedge may be dried on a plaster bat first. Clay which is too hard can be softened as follows: the clay is cut into many thin slabs with the wedging board wire. Each slab is sprinkled with water or smeared with slip. Stacked like a giant sandwich and pressed together, the clay can then be cut into slices in the opposite direction and dampened again. A few repetitions of this sandwiching will soon bring the clay to a wedgeable consistency.

Damp storage of work-in-progress must be considered, although it may not be necessary in elementary school classrooms. If possible, in working with young children, having everything ready beforehand and completing a clay project within a single class period is preferred. Decorating, in most cases, can be done after the clay has dried.

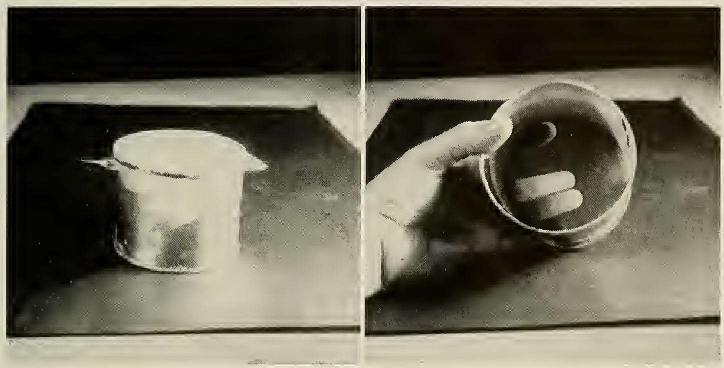
When it is necessary to keep clay pieces moist from one period to another, plastic bags are a boon: sandwich bags, bags in which bread and other foods are sold, shirt or dry-cleaning bags. These have several advantages over heavier plastic: they do not place any weight upon the work, require very little storage space when not in use, and cost nothing. Pieces which can be handled safely may be slipped into the bags. In other cases, such as sculptures, a bag may be inverted over the piece and tucked under the bottom of either the clay form or the entire bat on which it rests. Plastic bags can completely eliminate the need for a special cabinet, known as a "damp box", because the covered work can be set on open shelves or any convenient, out-of-the-way place.

The purpose of a permanent damp box is twofold: it keeps projects moist from one period to another and it permits the gradual drying that some pieces need to prevent cracking. How the work should be put into the damp box depends upon its efficiency. If it is tightly constructed, covering the work with damp cloths or placing a few water-saturated plaster bats within it should not be necessary.

An old refrigerator is excellent as a damp box, if space permits, but if very young children are in the classroom, the handle should be removed and a friction catch substituted. Cabinets can also be used as damp boxes if they are sprayed inside with aluminum paint or some other moisture-resistant finish.

The problem of keeping clay work moist is followed by its opposite—that of drying. This would not appear to be any problem at all; the pieces could be placed in the hottest part of the room and the heat would do the work. The tops of radiators, for example, may seem ideal but *fast drying will often cause pieces to crack.* It would be better to clear a bookcase temporarily, cover the shelves with newspaper and dry the pottery away from direct heat.

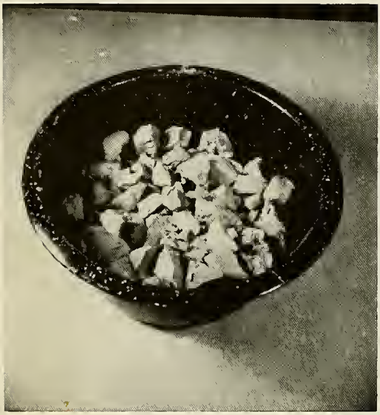
If drying proceeds too rapidly or very unevenly, the pieces may be covered lightly—not tightly—with thin plastic sheeting. Two small dowels or round pencils under each drying form will permit air to circulate underneath, thereby providing not only more even drying but "rollers," on which the clay can move as it shrinks. Permanent clay-working areas often include racks made from wooden slats, which permit all-around circulation for drying.

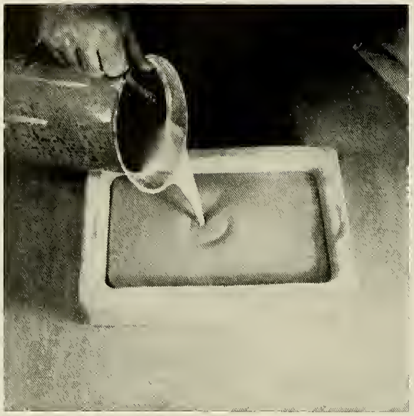


Strainers, which the potter terms "screens", are often needed in the preparation of clay, engobes and glazes. They may be easily and inexpensively made from fine bronze screening, purchased in a hardware store, and a metal can. The bronze screening, sold as "strainer cloth", may be purchased in 60 or 80 mesh; the larger the number, the finer the screen. Sixty is sufficiently fine for slips; eighty is better for glazes but will also serve for slips.

A coffee can is useful: it is shallow enough and wide enough so it will accommodate the hand if helping the material through the screen is necessitated. The screening is held against the outside rim of the can by a wire wrapped tightly around it. Excess screening may then be cut away with scissors or tin snips. The raw edges should be covered with masking or electrician's tape. Remove the opposite end of the can *after* the screening has been anchored to the open end. The closed end will help by giving the can more rigidity while the work is being done. A wall-type can opener will leave a smooth upper edge on the can.

Smaller screens can be made from smaller cans or a nylon stocking can be used as a screen if one is required infrequently. Ceramic supply houses can furnish more elaborate—and more expensive—screens in a variety of meshes.





CLAY-DRYING BATS A problem may arise in the classroom about the stiffening of clay slip, whether it be in connection with the preparation of plastic clay from purchased powdered clay or with the reclamation of clay scrap. Some suppliers—notably those furnishing clay in the plastic or moist state—will allow the return of scrap, to be reworked with the next large batch of clay ordered. Unless the supplier is nearby, however, this is not feasible and the scrap must be reworked in the classroom unless the budget is so generous that hardened clay can be discarded.

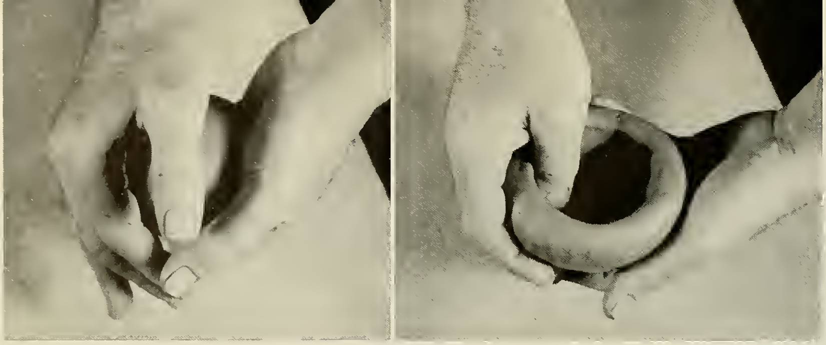
Reclamation could proceed in one of several ways. If a container, such as a plastic bucket, is partially filled with water and kept in a definite place, scraps may be thrown into it. Occasionally, depending upon the amount collected, the clear water standing on top should be poured off; the slip stirred by hand; screened to remove any particles or wooden tools, sponges or bits of plaster; and poured out onto or into dry plaster bats.

A second method would be to dry all scrap, crush it to walnut-sized pieces as illustrated and add it to a container partially filled with water—hot water if there is need for haste. When the clay has slaked—absorbed water—the same procedure given above may be followed.

A plaster bat, made especially for preparing plastic clay from slip, is essentially a shallow plaster box. The form of the drying bat permits the slip to spread out, bringing it into contact with the water-absorbing plaster over a large area, but prevents it from flowing away, as it would on a flat plaster slab. A drying bat can be made by casting plaster over any suitable form: a shallow plastic bowl or a dishpan, filled with moist clay to give it weight and inverted, or a simple clay form. The latter is probably easier, since there is no danger of "undercuts"—spaces between the rims of dishpans or bowls and the working surface. When such forms are used, the undercuts should be filled in with clay to prevent the plaster from running under them.

HAND-FORMING METHODS

Courtesy of Board of Education, New York City

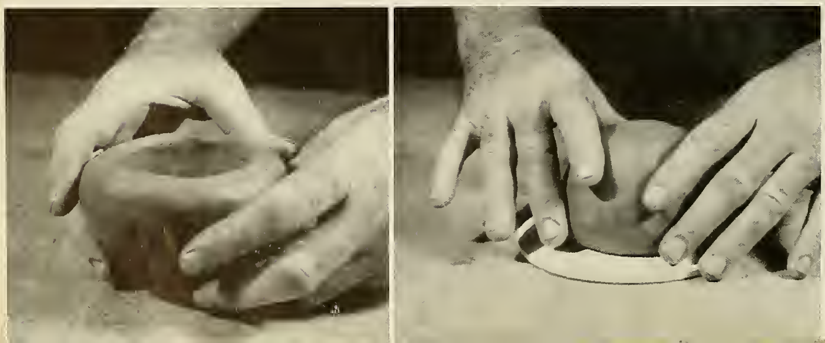


PINCHING This method of shaping clay is particularly appropriate as an introduction to clay work in the primary grades because it is rhythmic and simple. In addition, the very direct experience this method necessitates brings out immediately several of clay's qualities, so that it is suitable for students of all ages.

A pinch pot is started by patting into shape a ball of clay about the size of a small orange. When the ball is as round as possible, a hole is made by pushing the thumb to the center of the ball. The ball is then supported on the palm of the left hand, assuming right-handedness, while the hole is enlarged by keeping the right thumb in the center hole and squeezing against the clay wall with the fingers of the right hand. With each squeeze the ball is rotated slightly to the left and squeezed again. The center hole is enlarged by this rhythmic squeezing and pinching, forming the inside of a bowl or a more closed form—hence the name, "pinch pot."

A natural design forms on the outside of the bowl in the pinching process, the result of finger shape and ridges. This may remain to indicate the method of forming or the outside of the piece may be smoothed for decorating.

The bottom of the form may be flattened by holding the pinch pot a few inches above the working surface, then dropping it. The top rim may be leveled, if necessary, in the same way. The walls of these forms should remain fairly thick, for several reasons: (1) the thinner the wall, the greater the possibility that the form will become flabby, assuming a "rubbery" quality; (2) the heat of the hands dries these small pieces, even as they are being formed, and if pinching continues after the walls are quite stiff, cracking will result; and (3) thin-walled forms may develop very fine cracks, particularly around the rims, which will assert themselves on drying and firing. The forms should be simple and direct statements of the method.



POUNDING Paddling or pounding clay over a form offers a simple, direct way of making an open shape. This method is often practiced by Mexican potters as well as by our own Indians. It can serve beginners as an introduction to the more complex draping of a clay slab over a form or it can serve as a good method, in itself. The basic form over which to pound the clay could be a rather smooth roundish rock or the bottom of a wooden mixing bowl, for example. Since the inside bottom of the shape will be the same as the outside bottom of the form over which it is made, a rounded object is preferable.

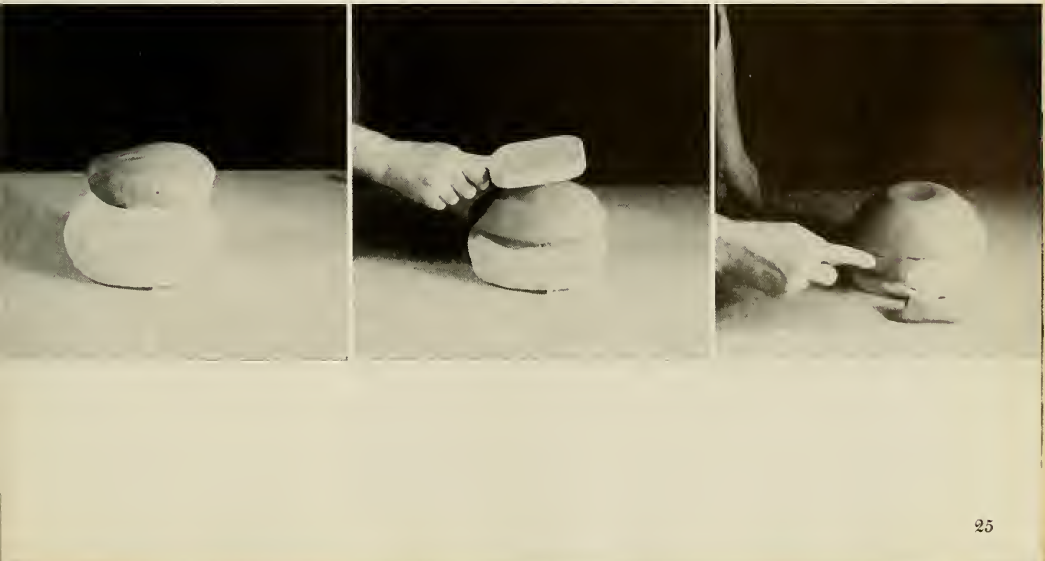
The clay must not stick to the form being used. A non-absorbent surface, such as a rock or the bottom of a glazed or oily wood bowl, should be covered with knitted cloth, dampened paper toweling or strips of newspapers, placed in the manner of overlapping spokes.

A lump of wedged clay is placed on top the form and pounded down around it, using either the hand or a wooden paddle. The thickness of the paddled walls can be checked by driving any thin, pointed object through the clay to the form beneath. These tiny openings will be closed as the work continues.

When the clay is of the desired thickness, the bottom of the form is flattened to make a base and surplus clay at the rim edge is cut away. The trimming can be done straight around the form or it may vary, so the rim of the finished piece will be intentionally higher in some sections.

The length of time during which the clay form may remain on the basic shape is determined by the latter. If it is a shallow hump, the clay *could* dry completely on it, for the clay form will raise itself from the hump as it shrinks. If the hump is steep and the clay has been formed to a less shallow shape, however, the piece should be removed as soon as it is stiff enough to handle, for it will not be able to raise its own weight during drying and will crack if allowed to dry completely on the form.

Several more or less half-spherical shapes could be made in this manner, then put together with thick slip to make an enclosed piece. The addition of a small coil, welded around an opening cut into the form, could result in a vase.



COIL BUILDING The base of a coil-built form may be made from a coil, with the resultant spiraling joint worked over firmly on both front and back. The base may also be cut from a flattened piece of clay or a clay disc may be domed slightly by pressing it over a form until it has stiffened somewhat, providing a cupped base.

Making the coils is an enjoyable manipulative experience for children. The clay should be quite moist, on the verge of stickiness, since the coils must be pressed together firmly as the form is built. The clay should be rolled out with the hands into rope-like shape, about ¾″ thick and 15″ long. If the clay is sufficiently moist, the ropes need not be perfectly round because a certain amount of pinching, to thin the walls, is part of the process of coil building. If the clay is too soft, on the other hand, the work will have to be interrupted by waiting periods while the form stiffens enough to proceed. Soft clay on soft clay will invariably slump.

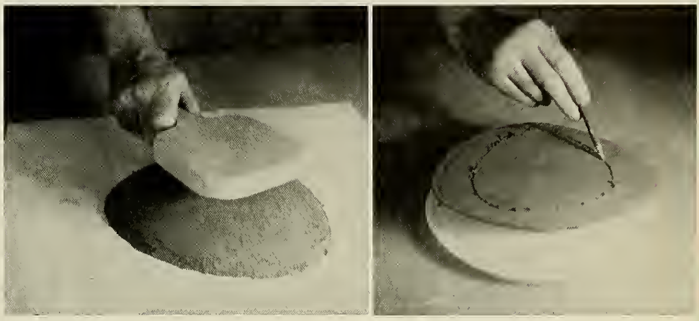
The coils may be used in one of two ways: each coil may be placed flat and joined to itself when it has gone once around or it may be used in a spiraling fashion, proceeding as far as it will reach, there to be joined by the next. The former method is easier for beginners because the form can be kept under closer control.

The form can be given an outward curve by placing the coil on the outside edge of the preceding coil. An inward curve can be made by placing the coil somewhat to the inside. A cardboard template or profile can be used to help keep the form symmetrical during the building process, although a greater sensitivity to form through visual and tactile senses will develop without this aid.

Some potters prefer to leave the pattern and texture of the coils and fingers as an honest expression of the way in which the form was made, allowing the play of glaze over them to provide "decoration." Sometimes, however, smoother surfaces may be desired for certain decorative techniques, as in the pieces shown here. In such cases, outside walls may be smoothed with a rigidly-held knife, a hacksaw blade or any convenient scraper.

SCOOPING One of the easiest methods of making clay shapes, scooping, is appropriate from the primary grades through college level classes. Professional potters have used the scoop or "hewn" method to form large pieces, sometimes several feet in length.

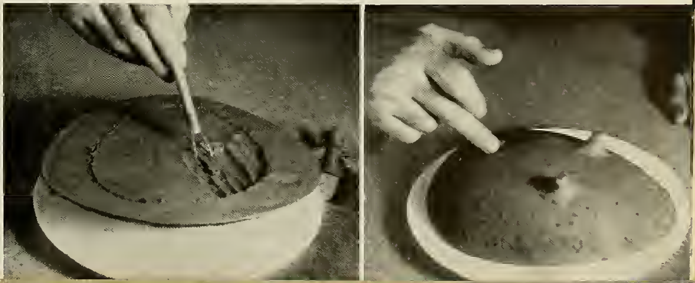
The scoop method begins in an upside down way. After the horizontal contour of the form has been decided upon, a solid lump of clay is shaped to the outside form desired. A lump of wedged clay may be thrown onto the wedging board or onto a sheet of reversed oilcoth or onto a dry plaster bat until it assumes roughly the shape intended. Working on dry plaster has the advantage of drying the face of the clay while the outside is taking form. Tools such as pieces of hacksaw blades or toothed scrapers can be used to shape the clay.

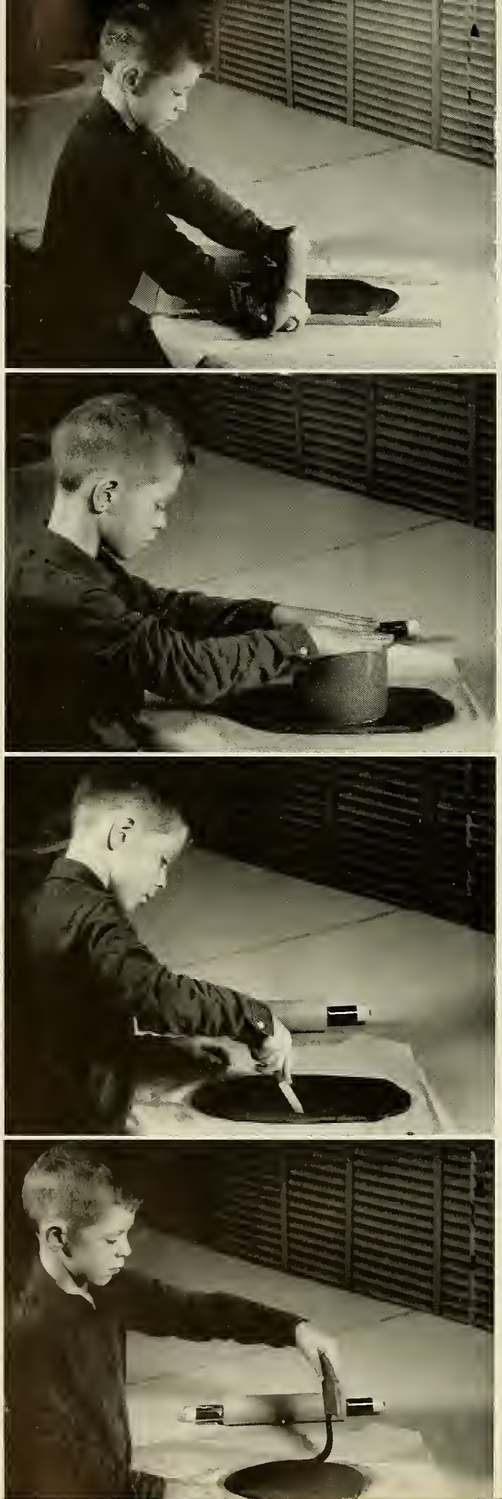


When the outer shape has been reached—and this need not be a long nor involved process—the surface may be smoothed with the fingers or the texture left by the scraper may be even more desirable. The bottom of the form can be pounded flat with a board to form a steady base. The addition, *after hollowing*, of three small bits of clay for feet will serve the same purpose. Three feet assure a more solid footing than do four.

If time permits, the form should be allowed to stiffen before turning over. If the clay is too soft, it may easily deform during inverting and hollowing. A wire loop modeling tool is best for scooping.

One advantage of this forming method is that the inside shape need not—preferably, does not—follow the contours of the outside, as it does in many pottery-making methods. Many possibilities for combining inner and outer shapes, especially in the case of free forms, to which the method is well suited, will occur to the student. The upper rim, always flat after scooping, may be modified by either adding or cutting away clay, so the horizontal plane of the rim is not constant, thus adding greater interest to the form.





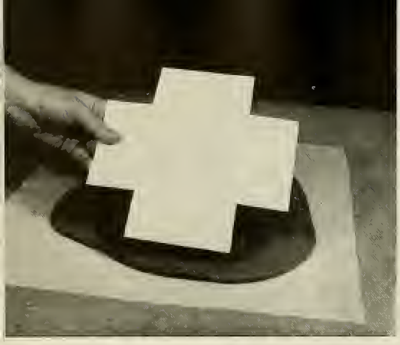
ROLLING OF SLABS Clay slabs may be used to make a variety of forms, from the simple tile to the complex sculptural pieces of many of today's potters. Whatever their destiny, the principle of forming the slabs is identical: the clay must be flattened.

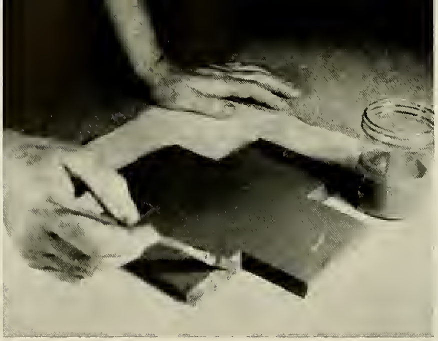
The simplest way to flatten clay evenly is to place it on the reverse side of oilcloth, canvas or burlap and roll it flat with a rolling pin or a length of pipe. Eighteen-inch squares of any of these backing materials will be found very useful in the classroom. Partial flattening, with the fist, the palm and the pin, will hasten the final rolling. For this, two guide strips of wood, 3/8″ x 1/2″ thick and about 18″ long, can be placed on each side of the clay, so the pin will ride on them. If clay lumps begin to build up on the rolling pin, leaving marks on the surface of the slab, the pin should be scraped clean and a second piece of oilcloth or canvas placed on top of the clay before rolling is resumed. If oilcloth is used on top, the *cloth* side should be next to the clay.

A clay tile is a project suitable for all grade levels. Tiles may be made to hang on walls as decorative units or grouped to form a mural. Round tiles are best for beginners, since the corners of square shapes are so easily broken. A circle is marked off on a slab, which remains on the cloth. The rim of a coffee can or any lightweight round object may be used as a guide. The shape is cut out, following the imprint, and a cut is made to the edge of the slab from the circle. The excess clay is then lifted away from the tile. *The tile is not lifted.* Lifting or moving the soft tile by hand will set up strains in the clay which, along with uneven drying, will reassert themselves and cause warping later. A plaster bat may be placed on top of the tile, then bat, tile and oilcloth flipped over together. This will position the tile neatly on the bat, with no handling.

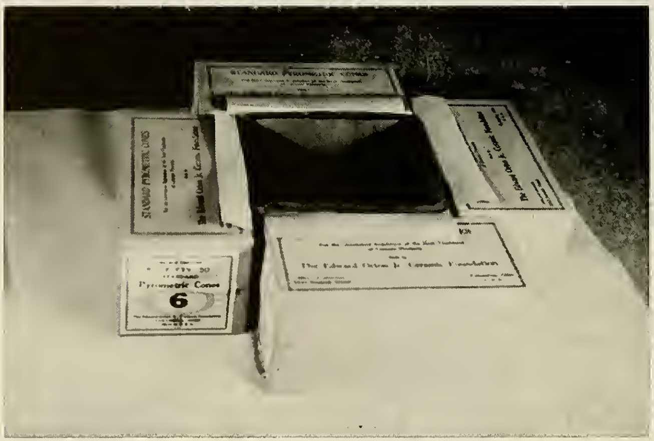
A good method for drying tiles is to make a stack of tiles-on-bats. Another method is to lay each tile on a table or other flat surface which has been covered with newspapers or paper toweling. A student can be delegated to turn the tiles a few times during the day so they will dry evenly on both sides. Since all unfired clay is fragile, the attendant should be reminded to handle them gently—particularly when putting them down on a flat surface.

When the tiles are leather-hard—stiff but still damp in appearance and to the touch—the edges can be "fettled" or trimmed. A knife blade, held at a 45° angle and used with a long scraping motion, will smooth rough or sharp edges. If the tiles are too dry for the knife to be effective, a kitchen pan scrubber—sponge on one side, abrasive on the other—can be used to soften the edges. After trimming, the edges may be further softened with a damp sponge.





From the simple tile, which helps the students understand the nature of slab work in general, further projects made either of single slabs or forms built from a number of cut pieces may be undertaken. A simple slab method piece can be made by cutting out clay in a shape similar to that of the Red Cross symbol. The four ends of the cross are bent up and the corners joined with thick slip, made of the same clay as the form. Joining slip may also be made with vinegar and clay: it has the advantage of requiring less liquid to achieve a paste-like consistency. All surfaces or edges to be joined should be scored before the slip is applied, assuring a better bond. If the edges to be joined are re-cut to 45° angles before attaching, they will fit more snugly. Whether or not this is done depends in large measure on the age and abilities of the class. The soft clay form may require some support until it has stiffened.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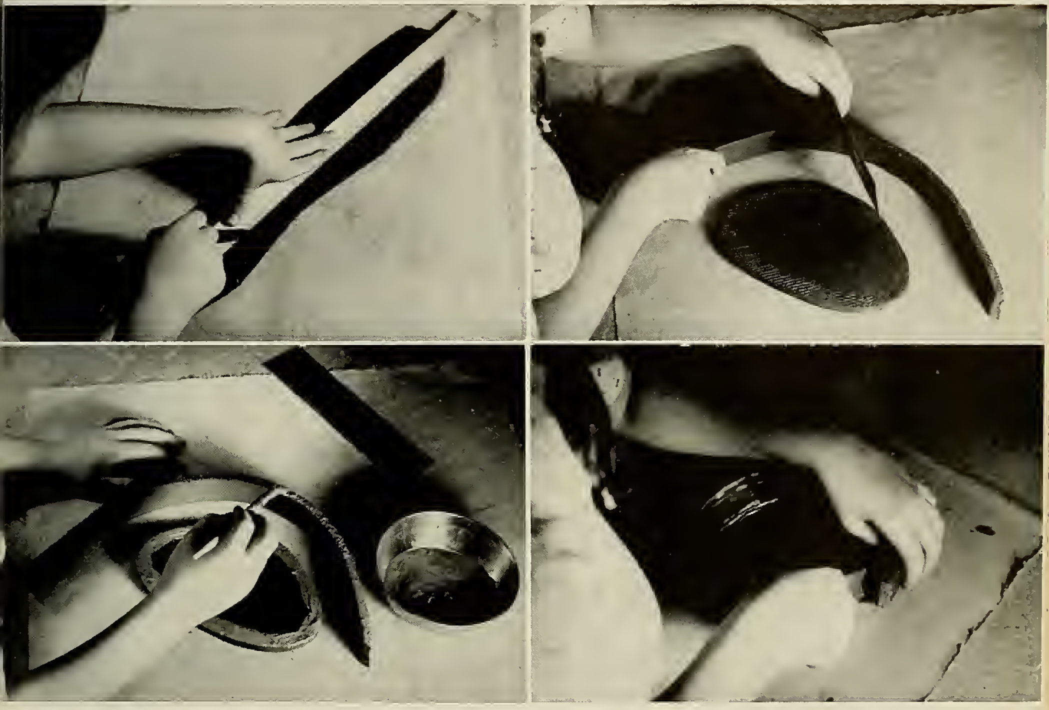
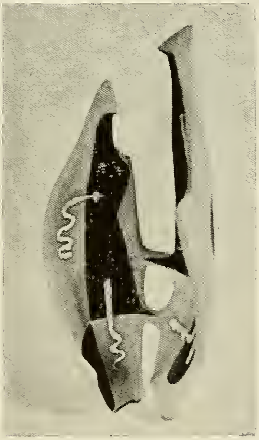


Round or free-form slab pieces may be made by first cutting the desired shape for the base from a rolled-out slab. A narrow strip, long enough to form the complete wall, is cut next. If judging the length required is difficult, a string can be placed along the top edge of the base; when straightened, it will provide an accurate measurement. The long strip is scored on one edge for its entire length and the base is also scored near the outside top edge. Thick slip is then applied and the pieces joined. The ends of the strip are cut at 45° angles, to provide a joint stronger than simple butting would afford. The form could be made taller by adding more narrow strips, much in the same manner as in coil building.

SLINGING Many beginning students' forms made by the preceding slab method, with flat bases and vertical walls, lack aesthetic appeal because they are "wooden," angular and squat. A slab-forming method which may provide a significant contrast and serve to illustrate the desirable "lift" and apparent buoyance of ceramic forms is that involving the use of a sling. The sling, not unlike a hammock, may be of knitted cloth or cheesecloth and may be supported in whatever place and by whatever method convenient. An open corrugated box will serve as support, with the cloth firmly anchored at the corners and along the edges by pins. A clay slab is placed in the sling, which may be manipulated and re-pinned to give the clay form the wall pitch desired. When the clay is leather-hard, it can be removed from the sling and transferred to a plaster bat to dry.

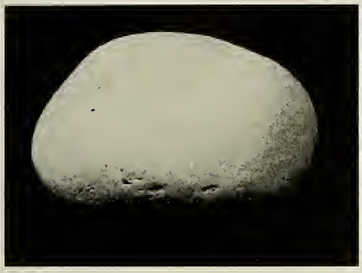
A second approach to the sling method is to cut a hole of any shape into the center of a piece of heavy cardboard. A piece of knitted cloth is stretched over the hole and anchored firmly with pins. The cardboard is then placed on an open receptacle, such as a bowl or wastepaper basket, which will afford support but permit a clay slab to be pressed down into the sling. Any part of the slab that does not drop down through the hole will form a flat rim on the clay form. For small shapes, a shoebox may be used, with the hole cut in the cover.



Maintaining the plastic quality of the material, clay, is not easily accomplished when working with slabs but should be undertaken. If the student can be encouraged to change the flat plane created by a "perfect" slab, by punching it out or in before stiffening, he may create a final form which will be not only more plastic in appearance but more interesting.

Another quality of clay, often of interest to the student as he rolls out a slab, is the way in which the edges of the clay develop short splits and cracks. Occurrences of this nature can be developed, often leading to forms that express the character of the material and of the individual better than do more precisely-made tiles. This is not to foster poor work habits in the student: control of the material and control of himself continue to be paramount goals. It is, however, a plea for the recognition of independent, if small, "discoveries" and the encouragement of their intentional use in planned projects.

DRAPING This method of forming provides an opportunity for the beginning student to combine his knowledge of making pieces by pounding a ball of clay down over a suitable form and his knowledge of rolling out clay slabs. Draping also offers the advanced student an opportunity to make plaster humps, either by hand or on the potter's wheel.



The shape over which clay is draped may be of any firm material. Even a stone with a smooth surface and an interesting shape may be used. It should be covered with a piece of knitted cloth or damp paper toweling before the clay is draped over it, otherwise the moist clay will stick to the surface and crack as it dries. The excess clay should be cut off either at or above the greatest diameter of the stone. If the slab is pressed into the stone below this point, the form will definitely crack during shrinkage.

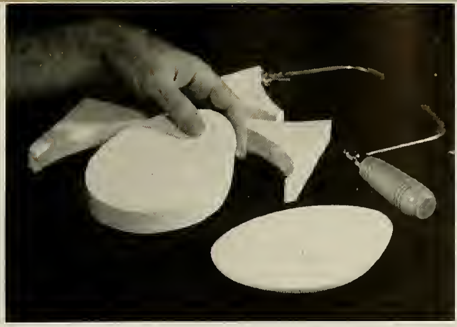
Draped forms should be relatively shallow, so that as the clay stiffens and begins to shrink, it can ride up slightly on the hump without cracking. If the angle of the side of the shaping form is too steep, the clay will crack over it in shrinking. The drape hump will shape the *inside* of the clay form only. The outside of the clay form could be made entirely different than the inside, either by cutting away or adding clay. The bottom may be flattened to form a base or—to assure even greater stability and grace for the piece—small feet may be built on immediately after the draping.

FORMING HUMPS A simple drape "hump" may be made from clay itself. A gently rounded mound of clay is made and smoothed. When the form has stiffened to the leather-hard state, it can be placed on an empty peanut-butter jar or something of similar shape to raise it from the table. It is then covered with a damp paper towel or a piece of knitted cloth. A slab of clay is rolled out and draped over the clay form. The bottom edge may be trimmed of excess clay with a wire cheese-cutter and the bottom flattened or legs added. When the clay on top of the hump has stiffened slightly (about one-half hour in a dry room), it can be removed and set upright on a plaster bat to dry. The rim edges may be modified or trimmed when the form is either leather-hard or dry.

More durable humps can be made from plaster by one of a number of hand methods. One great advantage of a dry plaster hump is that it draws water from the inside of the clay form while the atmosphere is drying the outside of the form. Non-absorbent humps permit the outside of the form to dry much more rapidly than the inside, thus setting up strains which frequently result in cracking during drying. In any event, it is wise to retard the drying of draped forms to prevent disappointments.

Although each student should be encouraged to make his own hump, preferably directly and without the use of a commercial form into which to pour plaster, existing items of bisqued clay, wood, glazed clay, glass or metal can be used as humps. Since their surfaces are non-absorbent, they must be covered with paper or cloth to prevent the clay from adhering to them and to facilitate the clay's shrinkage.

These beach pebbles, worn smooth by the action of water, provided inspiration for the student-made drape humps. The humps are well-designed for draping because they are simple in form—no "busy", undulating surfaces—and pleasantly rounded, without harsh, flat planes and the inevitable sharp corners resulting from such planes.

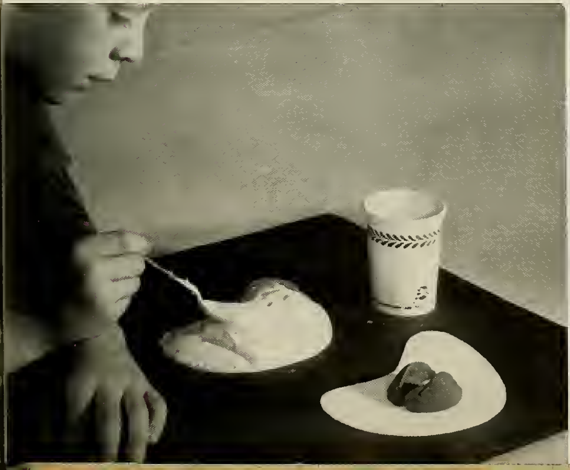


SAWING a blank from a thick slab of plaster is another way of making a hump. The slab may be made by pouring plaster into a shallow cardboard box. After the plaster has set and the box has been removed, the shape desired may be sawed from it. The bottom of the hump may have finger grips gouged into it, while the top is rounded and refined for draping.

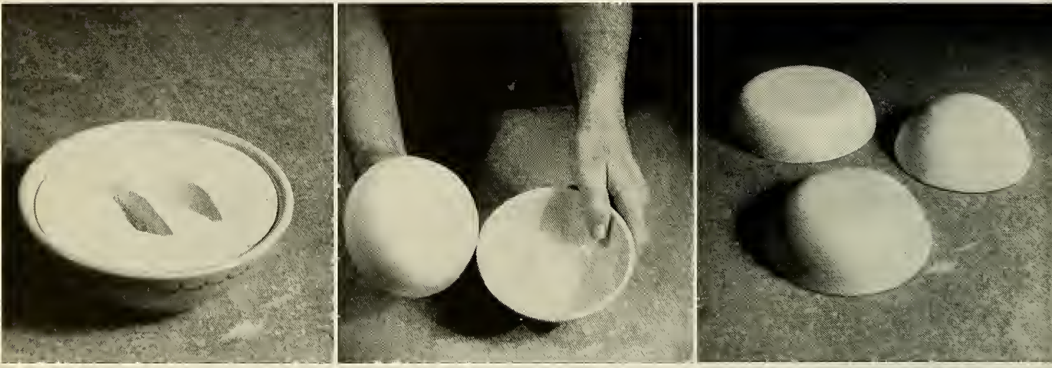
BUILDING directly with plaster demands control over the material by the student. This fact, in addition to his personal determination of the contour and depth of the hump, renders the method highly educational.

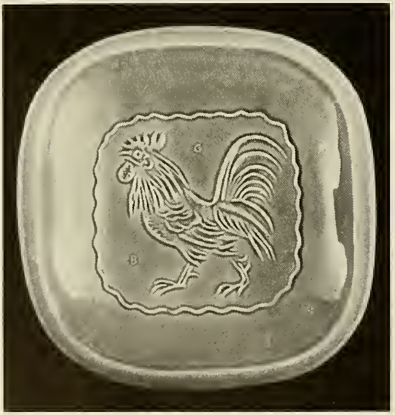
The contour desired may be cut from a piece of cardboard or drawn directly on a non-absorbent surface, such as a sheet of glass. Pieces of clay in the shape of orange slices are laid on the pattern and will provide future finger grips in the under side of the hump.

Plaster, mixed to a thick, creamy consistency, is piled onto the pattern until a rounded hump is formed. As the plaster continues to set, refinement of the surface may be achieved through the use of a toothed tool, such as a short length of hacksaw blade. Further finishing may be done with rasps, small pieces of window-screening, wet "rubber scrubbers" and, finally, with sandpaper of the wet-dry type. An excess of water is used to keep the abrasive surface of the sandpaper from becoming clogged with plaster sludge.



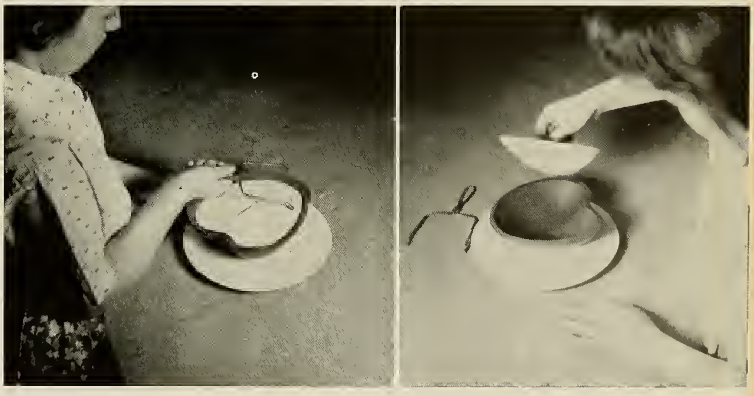
The least creative and, therefore, the least recommended method of making a plaster hump for draping involves the use of a sturdy pottery bowl, such as a soup bowl. The bowl is filled with mixed plaster. Two slots, to serve as finger grips, may be cut into the plaster before it is fully set. The plaster form can be removed from the bowl by inverting it, then tapping the edge lightly against a table top padded with several thicknesses of newspaper. Usually the plaster will come away from the bowl quite readily, so one hand should be held under the bowl to catch the hump. A number of bowls will provide a variety of shapes for drape molds.





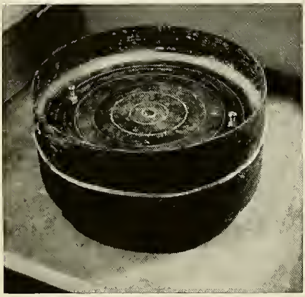
Drape molds may be irregular, round, triangular, rectangular or square in shape. An angular shape will be improved by softening the corners of the hump, so the rim of the clay form will not be too harsh in contour. The corners of the square hump over which this piece was made were generously rounded. When a design is carved into a plaster hump, the effect will be that of a relief pattern on the finished clay form, as this rooster illustrates.

A more complex method of forming a drape mold offers a furthering of mold-making experience. A form is shaped with clay, upside down, and plaster is poured over it, resulting in a negative mold. This mold could be used as a press mold or—when it has been soaped thoroughly—plaster could be poured into it, resulting in a hump. Finger grips are most easily cut into the hump before the plaster has set completely. Being able to refine the important draping surface three times—on the clay hump, in the negative mold and on the final hump—assures a more perfect finish for the drape mold itself.



MAKING A HUMP ON THE POTTER'S WHEEL Advanced students will find both challenge and pleasure in turning plaster humps for low bowls or plates on a motorized potter's wheel. The humps will be used for draping directly on the wheel, in a variation of the draping methods described previously. Some throwing skills are also used.

Forming shallow bowls and plates in this manner is often necessitated by the equipment available, a powered wheel equipped for the process known as "jiggering" being uncommon in school situations. The jigger wheel is capable of forming the inside of a plate or shallow bowl by means of a plaster hump—much as is shown in the modification illustrated on the opposite page—and of forming the outside by means of a rigidly-held template—as opposed to the hand method shown opposite. The adaptation illustrated will prove satisfactory for limited production and will provide the advanced student with several skills he would not otherwise acquire.



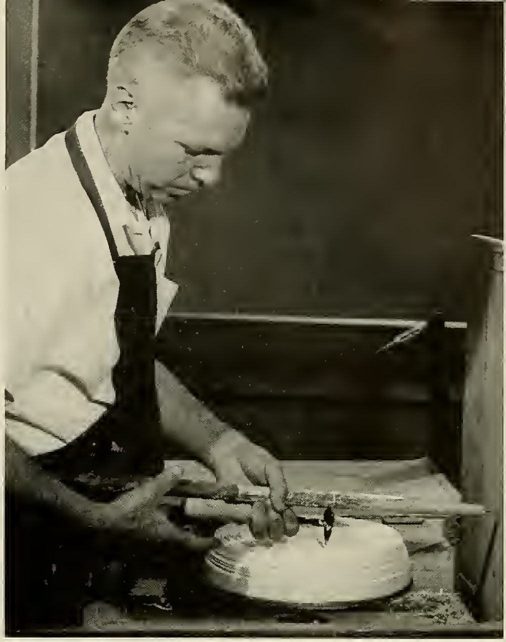
The wheel head is prepared for the pouring of plaster. The cottle is wrapped around the edge of the wheel head, with a clay seal on the inside.

If the potter's wheel being used has a flat metal head, as does the one shown here, some method of aligning the plaster hump on the head should be considered, so that each time the hump is to be used it can be easily and exactly centered on the wheel head, while at other times the head will be free for throwing.

One such arrangement would be provided by embedding bolts into each plaster hump. The bolts would fit into holes drilled in the wheel head. Two holes, 3/16″ in diameter, could be drilled opposite each other and about one inch from the outer edge of the wheel head. Two bolts, 3/16″ x 1″, could be fitted with one nut for each. The nut is screwed on until about 1/4″ of each bolt protrudes beyond it. The bolts are set into the holes, with the nuts resting on the wheel head, as shown above. When plaster is poured into the cottle, the bolts will be embedded in it. Each bolt will protrude from the plaster, so the hump may be removed and replaced easily.

A second aligning method would be to make a "lug" of wood or plastic, larger at the bottom than at the top, and attach it to the wheel head with bolts. Then, whenever a formed hump (or even a flat bat) is needed, plaster can be cast over the soaped lug, thus providing a cavity which will correspond to the lug.

Some potter's wheels are equipped with recessed heads, into which plaster bats are placed for throwing. Others have interchangeable heads, one flat and one recessed. Some wheels are supplied with casting rings made especially for casting plaster bats. In cases such as these, no extra arrangement for re-positioning humps or bats is required.

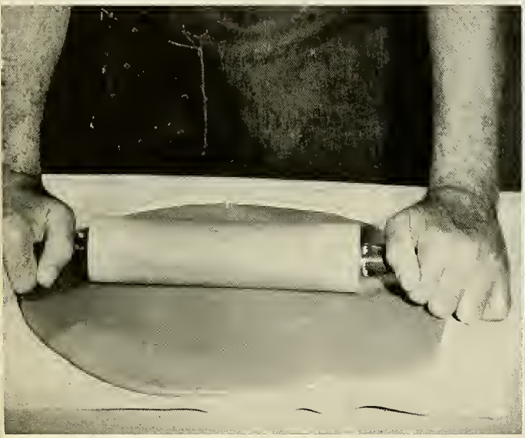


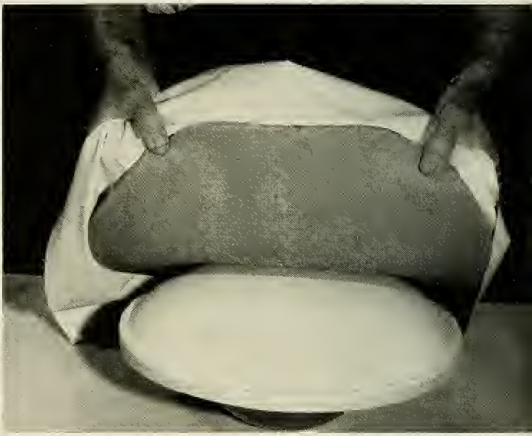
In using a motorized throwing wheel for turning plaster, two other equipment considerations are necessary. An upright wood surface, such as a firmly-attached drawing board, needs to be fastened to the wheel frame opposite the turner. A tool rest may be made from a broom handle cut to a length of 2½ or 3 feet, with a sharpened nail embedded in the rounded end. As this rest is held against the vertical board with the body, a short piece of wood fastened across the "body" end will add to the turner's comfort.

As soon as the plaster has stiffened enough for the removal of the cottle, the pointed end of the plaster turning tool is used to shape the hump. As the turning proceeds, a ledge is turned near the base of the hump. This will serve to form the rim edge of the future clay shape. The surface is turned to a smooth finish, using the side of the tool. The mold is dried before use.

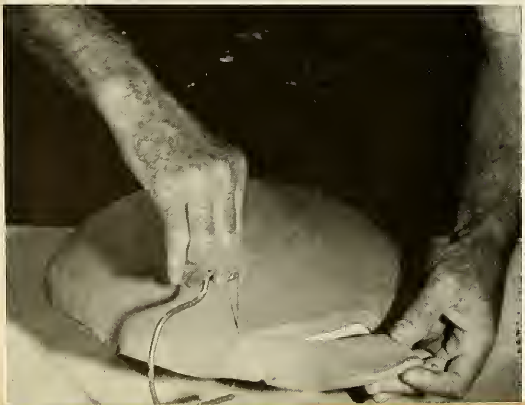
The design of humps to be used for forming plates and shallow bowls on the potter's wheel is governed by several factors. Since the hump will form the *inside* of the clay shape and since the clay shape will become more shallow during drying and firing, it is advisable to make the depth of the hump a bit greater than actually seems necessary. A *very* flat hump will undoubtedly result in a fired form resembling a pancake rather than a plate, so allowance should be made for the shortening of the rim.

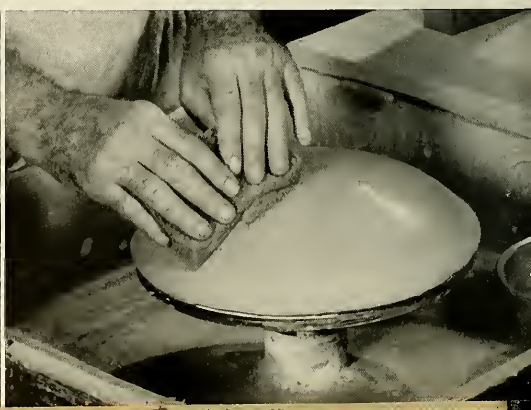
The curvature of the hump is also important. It should be "easy" and gradual, from the rim to the center. Steep angles on the sides and a flat top surface would not only result in an angular form but the clay might not withstand the strains which would be set up during drying on the hump.

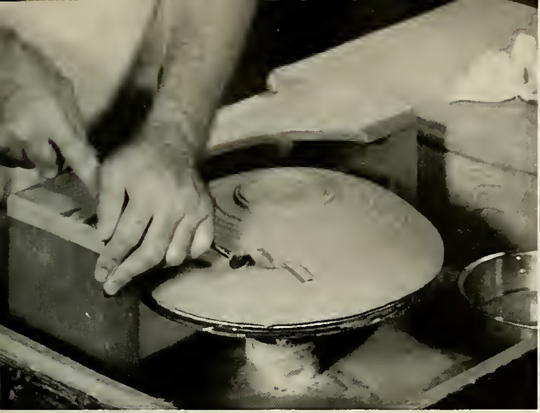


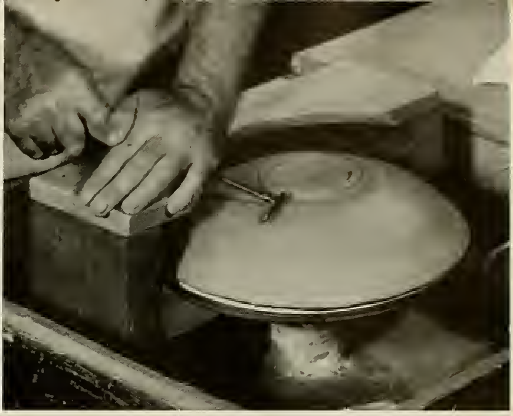


The clay slab for the form is rolled out evenly from the center. It should be fairly thick, in relation to the finished form. After the clay has been draped over the hump, excess clay is trimmed off. The clay is then pressed firmly onto the hump, with the wheel in motion and a wet sponge in the hand.

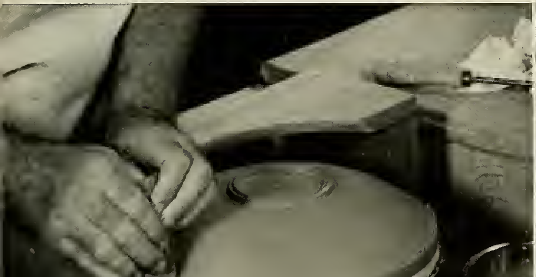


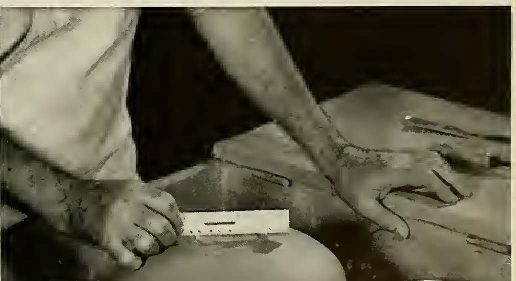


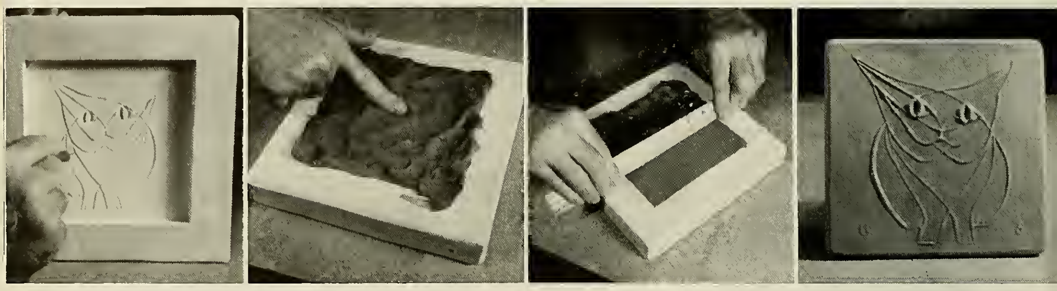




A foot rim is shaped first. Providing enough thickness for the foot is the reason for making the slab fairly heavy. The bottom of the clay form is trued, using the point of the turning tool. The surface is then smoothed with the edge of the tool. The edge may be trimmed with a wooden rib, an excellent tool for this step because it compresses the clay. The depth of the foot should be checked with a straight-edge, to assure sufficient clearance. A final sponging, if desired, and the hump may be removed from the wheel for the drying of the form, which should remain on the hump until it is leather-hard, at least.







PRESSING One way to produce a number of pieces similarly shaped is to press clay into a plaster mold. Some press molds are one-piece molds, designed to be filled solidly with clay, as are the two shown here. Others are used to form clay shells by building up against the inside walls, the opposite of draping clay over a hump.

The making of the mold must precede the pressing, of course, and the original form must precede the mold. A small tile may be shaped to the desired thickness in moist clay, placed face up in a shallow cardboard box large enough to leave a border around the tile, then covered with plaster. If the original tile has had a design cut into it, each pressed tile will reproduce the design. Sometimes the design is cut directly into the plaster mold, thus resulting in a raised line on the form. This method was followed in both the square tile and the round piece for ceramic jewelry, with its very delicate plaster carving and resultant fine raised line.

When the mold has dried, moist clay is pressed in firmly, with thumb and fingers. Excess clay may be removed with any straight-edged piece of wood. After a few minutes the mold is inverted and tapped gently on its edge against a table top to dislodge the pressed clay.

Similar molds can be made for small objects in relief, such as flowers, birds, small figures or animals. These small pressed clay designs may be added as decoration to the sides of clay bowls or to the inside bottom of a shallow bowl. They are attached with slip, provided both bowl and pressed piece are in a leather-hard or semi-moist state. They can not be attached successfully if the clay is dry. These small pressings are called "sprigs."

THROWING

Nothing is more fascinating to the general public than watching a potter at work upon his wheel and, if there is a single wheel in the classroom, the teacher's heaviest task concerning it will be scheduling to accommodate all the students. Some students will immediately find a great challenge, despite the difficulty of learning; others may become discouraged over the lack of cooperation from the clay but, even so, there will be more than enough who desire to master the wheel.

One theory about the name of this clay-forming method states that it was the practice of the potter, when his wheel was revolving, to *throw* a ball of clay onto the wheel head. When he had centered the mass, he proceeded to develop it into a bowl or vase, and thus the entire forming method came to be known as "throwing."

Potter's wheels are available in several types: motorized table and floor models, with one or more set speeds or with variable speed arrangements; and non-motorized, which must be kicked by the thrower, and may be of either the treadle or momentum type. The electric wheels most often found in classrooms are bench models. Since small wheels are prone to vibrate, they should be *bolted* to heavy tables or rigid counters. Wheels with one or more constant speeds should be avoided: greater variation in wheel speed is desirable. Variable speed bench models providing some foot- or knee-operated control are more convenient in use and are satisfactory for limited use by a number of students.

Wheels on which the flywheel is kept in motion by kicking a treadle may be either of the sit-down or stand-up type. These do not usually have heavy flywheels, so that the kicking must be almost—if not entirely—continuous. This has the disadvantage of causing the upper parts of the beginner's body to move but he will soon learn how to move the leg from the hip down—or, from the knee down, as the case may be—without moving the torso.

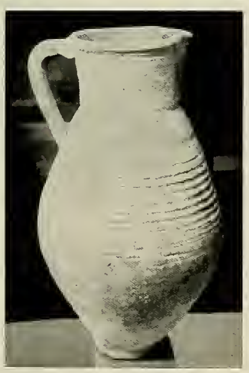
The momentum wheel has a very heavy flywheel, which is kicked directly by the potter seated above it. Momentum wheels are used more, on a world-wide basis, than any other type. The potter who throws day in and day out frequently prefers the superior "coasting" properties of the momentum wheel. A well-balanced flywheel can be kicked into rapid motion without great exertion. The kicking foot can then be rested away from the flywheel surface until such time as the speed diminishes, then a few kicks will suffice. Some momentum wheels are now powered, as well, so they may be brought up to speed either by kicking or by depressing a foot pedal, which engages the motor. These wheels are more space-consuming and more expensive than bench model electrics or treadle wheels but are freer of maintenance problems.

Wheels purchased for the classroom, or in any situation where a number of individuals will throw on them, permit more constant use if they are furnished with recessed heads into which plaster bats may be placed. Such an arrangement permits each student to remove his work, attached to the bat, whether it be for damp-box storage or stiffening before trimming. He can then replace bat and form on the wheel accurately at a later time if desired. If, however, the available wheel is fitted with a flat brass or steel head, discs of plaster can be held onto it either by some aligning device, such as bolts, or with thick slip under the bat or by a coil of clay around the bat. Being able to remove work from the wheel on its own bat immediately, without having to wait for the clay to stiffen a bit, is an advantage regardless of the degree of proficiency of the student. If the throwing is done directly on the wheel head, as is the practice of many potters, the following procedure may be used in removing the form: a piece of thin wire—at least as long as the wheel head is wide—is held taut on the head and drawn under the pot, cutting it loose. If the pot does not come loose with the first cut, it may be repeated two or three times. A flat, thin lifter, such as a pancake turner blade, is then slid under the piece and it is carefully transferred to a plaster bat to stiffen.

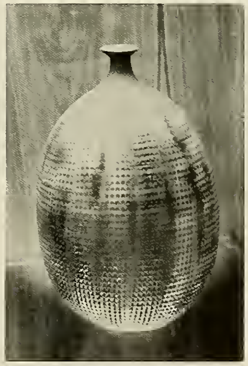
Clay for throwing should be plastic and fairly moist. If too stiff, it will be centered only with difficulty and wasted time. If too soft, it will tend to deform when the pulling-up stage is reached. Some clays and clay bodies are better for throwing than others. Those with a somewhat coarse and open texture seem to withstand overworking better than those of fine grain, which have a very slick surface when wet.

Preparation for throwing includes assurance that the clay ball is of equal consistency throughout. Wedging, whether on a wedging table equipped with a cutting wire or on any flat surface in the oriental manner, must be thorough. Hard and soft areas in the ball of throwing clay will result in difficulties which usually can not be overcome, especially not by beginners. Air pockets, too, can cause difficulty throughout the throwing, so wedging should assure that these have been expelled. Balls of clay for beginners should be between the sizes of a softball and a small grapefruit.

Exasperation and pleasure both attend learning to throw on the wheel. Suddenly, there comes a time when everything seems to work together: the wheel, the clay and the thrower. But it is the latter who determines the degree of success.

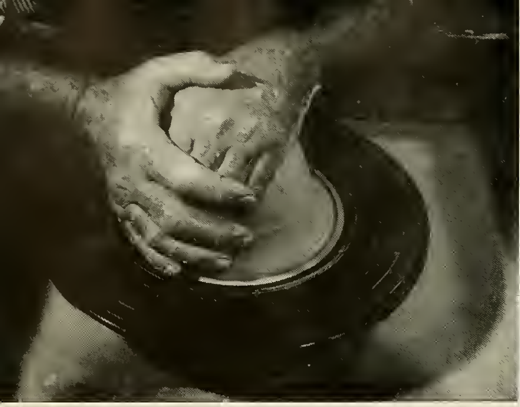


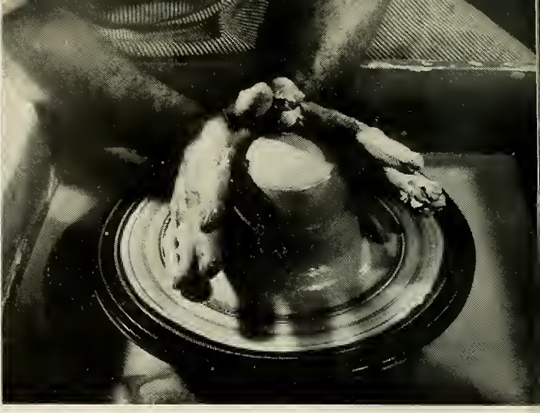
Courtesy The Chicago
Natural History Museum



Courtesy The Krannert
Art Museum, Univ. of Illinois

Separated by 2000 years—but not by forming method or spirit—are the red clay Roman pitcher and the stoneware vase by Vivika and Otto Heino of California. Each form is "full," not restricted or cramped in profile or volume. The presence of the ridges, particularly visible on the pitcher, states firmly that the piece was thrown on the wheel.

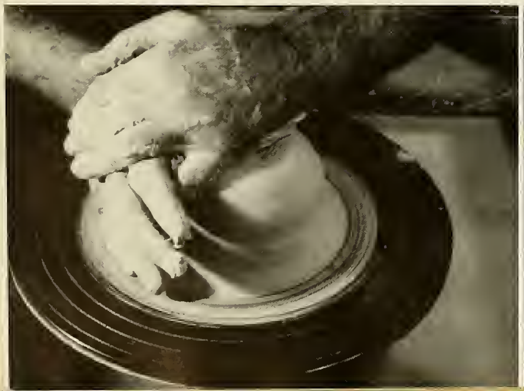


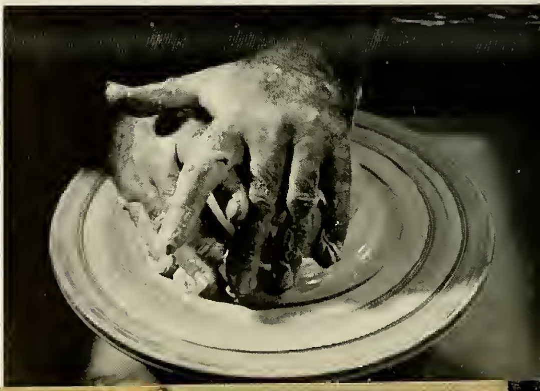


CENTERING Learning to center is to become the complete master of the mound of clay on the wheel. Centering is not as much a matter of muscle as it is of realizing the principle involved: *the mass of clay must be controlled on all its surfaces with equal force.* If this is done, there is no opportunity for irregularities to move, over and over again, from top to sides and from sides back to top. Firm, equal pressure will bring the clay to an even, smooth, rounded mass quickly. In general, the two hands are opposing members, giving the clay only one constant opportunity: to come on center. The speed of the wheel plays an important part: centering is easier at high speed.

There are almost as many ways of holding the hands for centering as there are potters. Although a beginner will benefit from watching others throw, he will soon find his own way of working. Initial pressure, begun with the wheel in motion and enough water to provide lubrication, may be exerted on top the clay, assuring firm attachment to the wheel head. The clay may next be either pushed or pulled roughly to the center. The final motion may be made by pushing with the heel of the right hand while the side of the left hand rides on top. Unless the ball of clay is too large to permit it, the hands should be touching each other at all times, even though their forces are opposing.

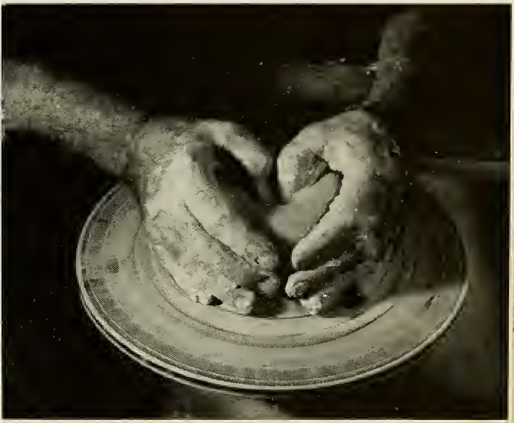
All too often a student will succeed in centering a ball of clay very quickly, then knock it off center while removing his hands from it. Both hands should be





removed while the wheel is in motion and at the same time. How fast the wheel is traveling is unimportant: it is the hands that should be moving slowly, gently and equally, as they are withdrawn. The same is true of bringing the hands back to the work, regardless of the point to which the throwing has progressed, from centering to final touches on the finished form.

How the clay is centered and when it *is* centered are best determined by practice. After a few, seemingly inevitable, attempts to make a form from a poorly-centered ball, the student will see the necessity of conquering this step in the process of throwing.



OPENING Following the centering, a hole must be made in the clay. Usually the centering process has resulted in a slight depression on the top of the mound. This serves as a starting point for the opening, which must be in dead center. If it is not, all the previous work of centering is lost.

There are many ways of opening, during which the wheel speed may be quite rapid. Shown here is the use of both thumbs, set into the center of the mound, then pressed downward together until the bottom of the hole is approximately one-half to three-quarters of an inch above the wheel head. The hands serve to keep the outside of the mass running true. If the mound of clay is too wide or too tall for the use of the thumbs, the heel of the right hand is sometimes used. Some potters use only one finger or the thumb of the right hand when working with small balls of clay. In any event, the two hands should be touching each other if possible, since this helps to keep them steady and on center.

RAISING THE CYLINDER The throwing of almost every form, be it vase, pitcher or bowl, begins with the making of a cylinder. Throwing the cylinder is, then, very basic. It is not easily accomplished in a single session at the wheel. When it has been conquered, however, the walls are of equal thickness and the shape has some relation to the projected form. The most difficult part of learning to throw has been mastered when a good cylinder can be made.

The center opening in the clay should be enlarged until its diameter is approximately equal to that desired for the inside bottom of the pot. This results in a low cylinder with very thick walls, which must be raised upward. This step is known as "lifting", "raising" or "pulling up." Methods of raising are numerous. Some potters always use a sponge in the outside hand, others inside; some use only finger tips, others knuckles outside and finger tips inside; some use one hand only, with the fingers inside and the thumb outside; others the thumb inside and the fingers outside, working on the side of the clay opposite the thrower. Regardless of the hand positioning, the principle involved is the same: there must be two opposing forces through which the clay passes.

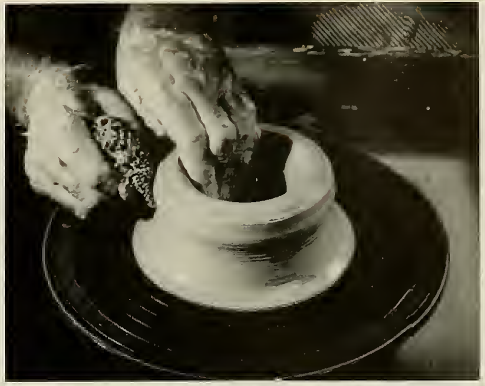
As the pinching movement, begun always at the bottom of the cylinder, rises to the top, the walls grow taller and thinner. Beginners should brace elbows or forearms against the body, the wheel frame or an arm rest, so that the raising can be done steadily. Many potters hold their breath during each upward pull, as a further guarantee of steadiness. Each upward pull is accompanied by a decrease in pressure near the top of the cylinder, so the upper edge will not become paper-thin while the lower parts are still fairly heavy. Wheel speed should decrease as the work progresses.

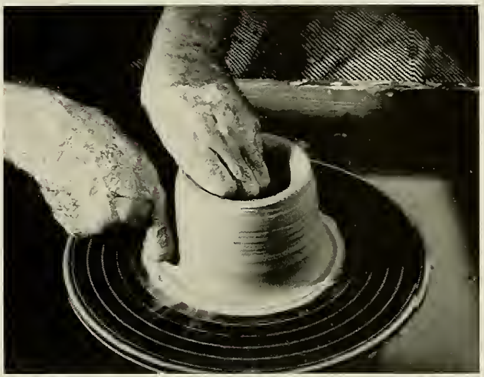
The wall, as it is pulled up, has a natural tendency to spread outward through centrifugal force, so it may be necessary to bring it back by a movement known as "choking in" or "collaring." This is done with the wheel in motion, as are all parts of the throwing process. Both hands are set around the clay near the wheel head, touching each other if the size of the form permits. Gentle squeezing, while raising the hands, will coax the clay wall back to the vertical. Collaring thickens the walls, necessitating further raising.

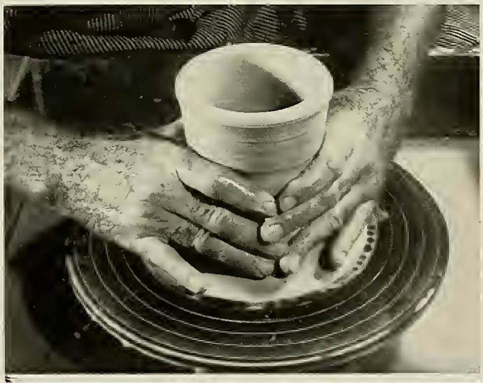
Beginning throwers should cut their cylinders in half vertically, so they can see whether the walls are consistent in thickness; whether the center opening is too deep; and whether they recognize, by touch, an air pocket for what it is.

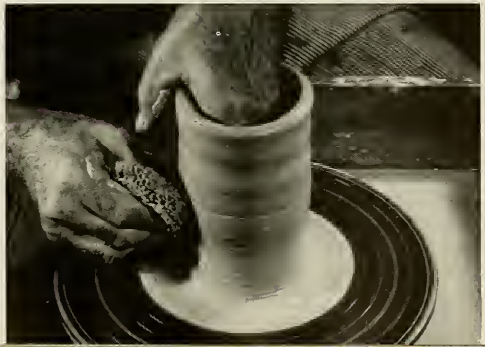
There should be no set rule for the appropriate wall thickness. That depends upon the size and shape of the form to be made from the initial cylinder. If a student can manage a consistent wall, about as thick as a lead pencil, from a ball of clay about the size of a softball, he is well on his way and ready to attempt a vase form.

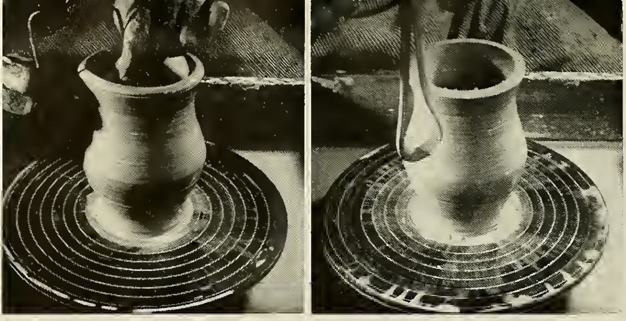
A simple vase form starts with the basic cylinder. The hands are used just as for pulling up except that there is little or no pressure between them. They merely move the clay outward or inward from the cylindrical shape. The form can be made to swell outward by greater pressure from the inside hand and moved inward by greater pressure from the outside hand or by collaring.





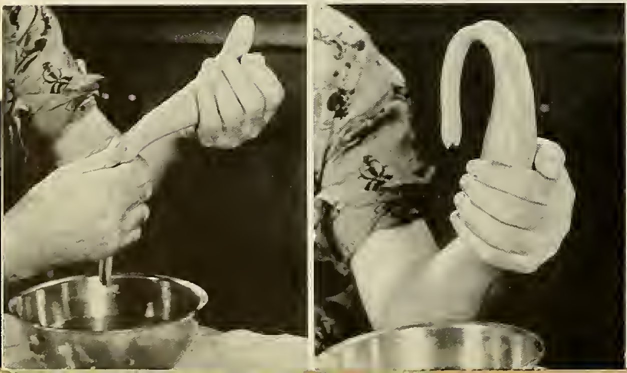


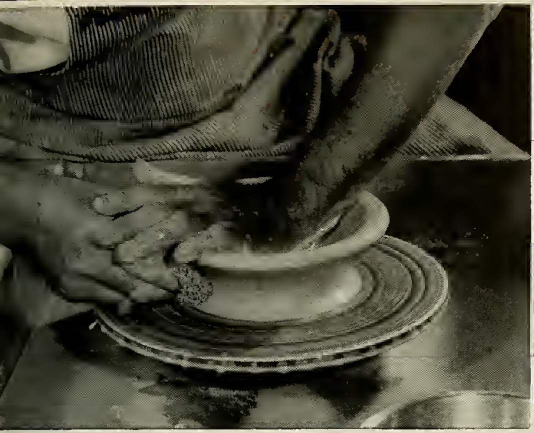


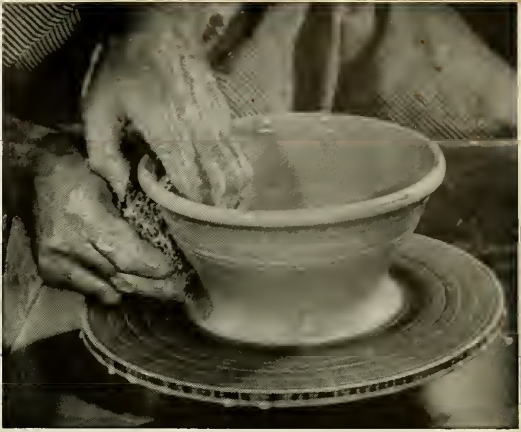


CUTTING One of the principal aims of the thrower is to prevent uneven walls, the pulling up of which sometimes results in a rim higher on one side than another. Occasionally, leveling the rim or cutting off the upper portion of a form is necessary. A cut-off tool of some type is then needed. A wire cheese-cutter may be used, holding it steadily and lowering it gently onto the top of the clay as the wheel revolves, permitting the wheel several revolutions when the cutter has reached the desired depth. If the wire is lifted quickly, the cut clay will come away with it. Some potters prefer a large hat- or corsage-pin or a darning needle held in a wooden handle. While the wheel is in motion, one of these is forced through the wall to the left hand within. If both hands are raised rapidly, as soon as the needle point touches an inside finger, the clay will come away from the form.

PULLING A HANDLE Handles for thrown forms may be made by several methods. The one shown is termed "pulling." A wedge-shaped piece of moist clay is held in the left hand, tail down. The right hand, which must be kept wet by frequent dipping in water, makes a series of pulls away and down from the left hand. If the thumb of the right hand rides on top the clay, a functional groove will form on the outside of the handle. When the clay is inverted, the handle will form a graceful curve of its own weight. After slight stiffening, the surplus mass is cut off at the angle which permits the most pleasing relationship between the handle and the form on which it is to be placed. Handle and form should be in approximately the same state of hardness when combined. The pulled handle is preferable to a round coil or a flat strap because it seems to "grow" from the form—in much the same way a branch grows from a tree—so there is a greater unity, both visually and physically.

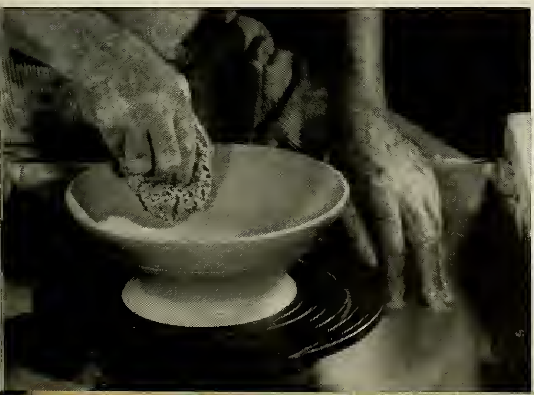


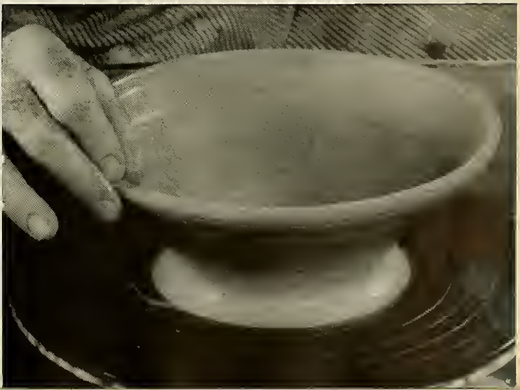


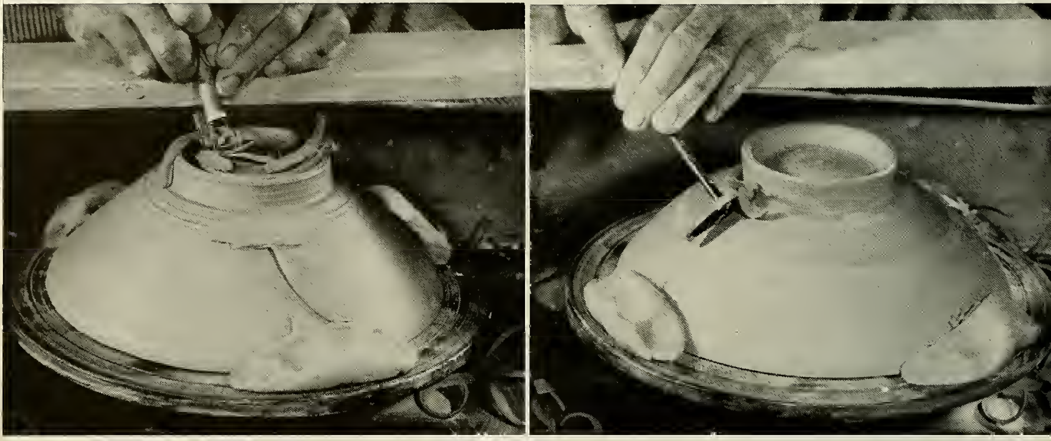


THROWING A BOWL A shallow bowl is one of the easiest forms to throw because the clay has a natural tendency to flare outward. When the clay has been centered in a mound lower and wider than that for a vertical form, the opening may be made with the heel of either hand, pressing down until the desired depth in the center is achieved. As the rim of the shallow bowl is forced outward by the heel of the hand, the fingers of the same hand are curled over it to keep it even, both in thickness and in height. The other hand acts as a support on the outside of the form.

Care should be taken not to make the form too shallow and wide during the opening because the walls will need to be raised somewhat. It is almost impossible to do this if the wall is flattened too soon, so that it is virtually parallel to the wheel head. The walls will thin further as the diameter of the bowl is increased. This may be done by pressing outward with a sponge or by using both hands in the same position ordinarily used for pulling up but without raising clay—merely moving it outward. At the end of the forming process, the rim is likely to be flat, with sharp edges. The fingers or a sponge folded over the edge for a few revolutions will give the rim a more pleasing shape. A delicate touch and low wheel speed are needed.







TRIMMING Trimming the form, after it has stiffened enough so it may be inverted without damage, is the easiest part of the throwing process. Before inverting the piece, the amount of clay which can be safely cut away should be determined. Deciding upon the appropriate diameter, appropriate placement and thickness of the foot-rim-to-be should also be undertaken at this time. When centered, the pot is affixed temporarily to the wheel head with a few pieces of moist clay. The hands must be held quite rigid during trimming and this may be facilitated, in the case of some wheels, by placing a board across the frame. Other wheels permit the turner to rest his forearms on the wheel frame or on his thighs.

A loop tool of round wire may be used for trimming. A flat steel loop, however, is more efficient in cutting. It offers less resistance to the clay surface and is self-sharpening. If desired, a round wire loop may be sharpened by filing. An indication of the foot diameter and its thickness should be made immediately upon the bottom of the inverted form. Beyond that, the trimming may proceed in any order and with whatever tools the potter prefers.

Students should be encouraged to complete the turning without having to remove the pieces to check progress, since it is often difficult to recenter their not-too-true forms. The foot rim may be sponged lightly after trimming, a signature scratched in if desired and the now-finished pot set aside to dry.

PLASTER

Peabody High School, Pittsburgh, Pa.

Although it is possible to make many things of clay without ever using plaster, this material is a valuable adjunct in all phases of clay working and a necessity in some methods of forming. Other than the fact that molds are made of it, plaster bats on which to work, plaster drying bats, plaster sheets for stiffening clay slabs, humps and wedging surfaces are but a few of the classroom clay-working aids it provides.

In one sense, plaster is the natural enemy of clay. If particles of plaster should be embedded in a piece of clay to be fired, they have the property of swelling slowly through the absorption of moisture until hydrostatic pressure eventually pushes out a piece of the fired clay wall and thus ruins what was assumed to be a successful piece. This defect, called "dunting," may occur a week, a month or longer after the piece has been fired. Care must be taken, therefore, to see that no crumbs or bits of hard plaster find their way into clay that is to be fired. Whenever possible, work with the two materials should not proceed side by side.

PURCHASING AND STORING PLASTER A fine grade plaster, called "pottery plaster," is available from ceramic supply houses and other sources, but for economy and ease of procurement, the plaster sold by local building-supply companies under the name of "molding plaster" is satisfactory for use in the classroom. Plaster should be fresh upon arrival; it can deteriorate in time, especially if the bag is broken or has been stored in a damp place. Plaster has the ability to draw moisture from the air. If it becomes too damp, it will be lumpy and difficult to use. Storage, therefore, should be in containers having reasonably tight-fitting lids and in a place free of excessive dampness. These precautions are more necessary in a classroom where the plaster is used infrequently than they are in one where the use is fairly constant.

MEASURING PLASTER The proportion of water to dry plaster determines the quality of the set plaster. Too little water will make a very dense product, while too much will make a soft, weakly-set mass. A proportion used in mixing plaster for clay work is two pounds, twelve ounces of plaster to one quart water. This results in a cast plaster found to have the best qualities for working with clay, particularly for molds.

Scales for weighing plaster are desirable. An ordinary kitchen platform scale is satisfactory and inexpensive. It can be adjusted to compensate for the weight of the pan or other container in which the dry plaster is placed for weighing.

If no scale is available, there is a rule-of-thumb method of measuring—less precise but workable: the amount of water needed is determined and poured into the mixing container, then plaster is shaken into it until a mound of plaster forms an inch or so above the surface of the water. This will provide approximately the correct amount of plaster for the amount of water being used.

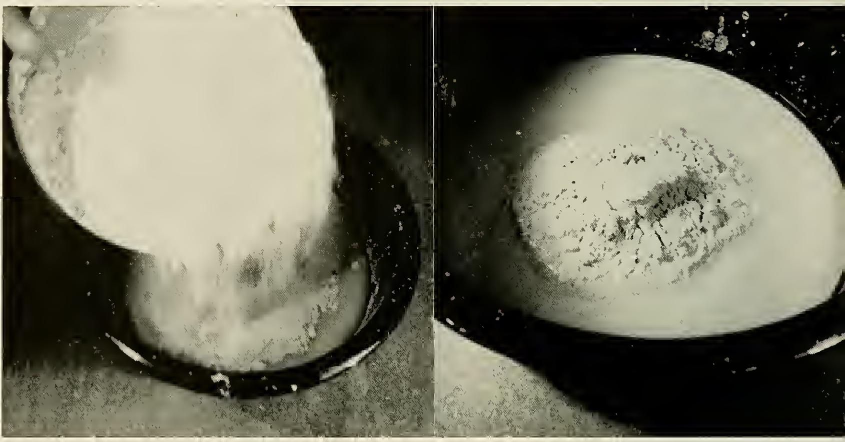
ESTIMATING PLASTER REQUIRED The principal reason for estimating carefully the amount of plaster and water for a particular problem is to be certain that enough plaster is prepared in one mix. Unless estimates are made, students usually mix insufficient amounts, then the process must be repeated needlessly. It is a good practice to mix a little more plaster than the estimate calls for. The amount left over, if any, can be used to cast a bat, provided a pie plate or shallow box is ready for filling.

One quart of water and 2 lbs., 12 oz. of plaster (or until the small mound is formed in the water) will make 80 cubic inches of cast plaster. This fact makes it possible to estimate the amount of water and, consequently, the amount of plaster needed for a specific problem. If casting into a square or rectangular box or form, the width times the length times the height of the cavity will determine the cubic inches therein. The figure is then divided by 80, the number of cubic inches of plaster provided by one quart of water and 2¾ lbs. plaster. The result of this computation is quarts of water required. For example: to cast a block 5″ x 6″ x 8″, a total of 240 cubic inches, divide 240 by 80, to determine that 3 quarts of water and 3 x 2¾ or 8½ lbs. plaster are required.

In estimating the amount of water and plaster needed for a circular volume, the area of the circle is multiplied by the height. The area of the circle may be found roughly but quickly by multiplying the square of the radius by three: thus the area of a six-inch circle is the radius (3) squared (9) and multiplied by 3, equaling 27 square inches. A 10″ circle, following the same rule, will have an area of approximately 80 square inches. One quart of water, with its 2¾ lbs. plaster, will cast a circular bat 10″ in diameter and one inch thick, or it will cast a rectangular bat one inch thick and 8″ x 10″ in size.

Gerd Bogelund
Royal Porcelain Manufactory

Courtesy Den Permanente
Copenhagen



MIXING PLASTER When the suggested amounts of water and plaster have been determined, they are mixed as follows: (1) cold or tepid water is measured into the mixing container; (2) the plaster is weighed and shaken into the water slowly; (3) the mixture is permitted to "slake"—remain without stirring—until every particle has taken on water, requiring perhaps 5 minutes; (4) the plaster is stirred with the hand in a sweeping motion, to assure an equal consistency—no water on top or heavy plaster in the bottom; (5) stirring continues, with the hand *under* the surface so that air will not be stirred into the mix; (6) stirring may, from this point, be either continuous or intermittent, depending on the use to be made of the mix.

Continuous mixing will bring the plaster to the point of use more rapidly than will intermittent mixing. The value of intermittent mixing is that the plaster will have a longer period of "plasticity" during its setting time, whereas plaster mixed continuously will proceed more rapidly through the setting. Both the "regular" (continuous stirring) and the "delayed" or "slow" (intermittent stirring) mixes have advantages for specific tasks.

There is no definite length of time required for the plaster to be ready for use. If the plaster is to be poured, as in making a bat or a mold, it may be used when a finger drawn across the surface leaves a slightly visible trail. Two other tests: if the plaster almost—but not quite—drips from the finger tips as the mixing hand is held, fingers down, above the mix, it is ready; or if a clean, dry finger dipped into the mix is well-coated when removed, the plaster is ready to use.

When the mix is being used for building—as in the cases of multiple-piece molds for sculpture and direct modeling—it needs to become a bit stiffer. Otherwise, it will run off the attempted work. When plaster starts to set, it does so rapidly and must be used without delay; there is no need for panic but close attention to the work is necessary.

PLASTER SEPARATORS When a mold is made over a plaster model or when a multiple-piece mold is made, plaster surfaces against which new plaster will be cast must be treated so that the parts will separate. Theoretically, any material which will render the plaster surface impervious to water may be used. Those available from ceramic suppliers under the name of "mold soap," "plaster separator" or "plaster stop" are preferable. The advantage of mold soap over a thin coating of petroleum jelly, for example, is that the soap will not tranfer from one surface to another, a defect which—when it occurs on the working surface of a mold—can impede the absorption of water from clay slip when the mold is being used for casting.

Mold soap purchased for classroom use will undoubtedly be in liquid form, ready to use. It is also available in paste form and, when so purchased, must be heated with water to form a liquid, usually in the proportion of one part soap paste to six parts water.

A definite procedure, followed in soaping, provides the most efficient separation of plaster surfaces. Although it may seem complex, the soaping process requires but a few minutes working time:

1. Two or three tablespoonsful mold soap are poured into a small bowl.
2. A clean, soft sponge (such as an elephant ear sponge) is half-saturated with clean water.
3. The sponge is dipped into the soap.
4. A loose lather is worked up between the palms of *clean* hands.
5. The lather is rubbed thoroughly over the entire surface being soaped.
6. IMPORTANT: THE SPONGE IS NOT RINSED.
7. Remaining loose lather is squeezed from the sponge.
8. The sponge is re-dipped into the soap.
9. A stiffer lather is worked up between the palms.
10. The lather is applied.
11. Excess lather is removed with squeezed-out sponge: sponge is *not* rinsed.
12. The soaped surface is tested by placing a drop of clear, clean water on it. If the water is not absorbed, the soaping is complete. If absorption is observed, the sponge is again dipped in soap and steps 9 through 11 are repeated. The tested spot is finally touched up with the sponge, which will still contain enough soap.

Occasionally, there are surfaces which require soaping, yet are too narrow for easy use of the sponge. In this case, a soft brush may be used to apply the lather and a dry brush used to remove all bubbles.

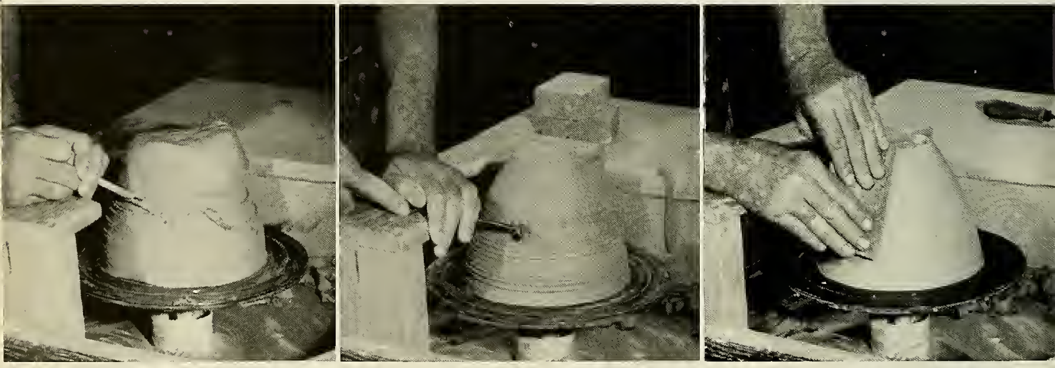
When the surface has been soaped, it should not be touched with the hands. To do so may impair the effectiveness of the separator. Similarly, if there is a clay surface (such as a clay model) adjacent to the surface being soaped, care must be taken not to smear over the clay and onto the plaster while soaping. Clay particles cut through soap and negate the soaping.

A lather made with cake or liquid *soap* (not a detergent) will sometimes serve as a substitute for commercial plaster separator and it *is* possible to use a thin coating of petroleum jelly except where working surfaces of molds are being formed. Mold soap is dependable and it is so inexpensive that it hardly pays to use a substitute.

ONE-PIECE MOLDS Cups, tumblers, bowls—in short, pottery shapes which flare outward from the feet to the rims, with no reverse curves in their profiles—may be reproduced in one-piece, drain-cast molds. Such molds are the least complex, the easiest to make and to use.

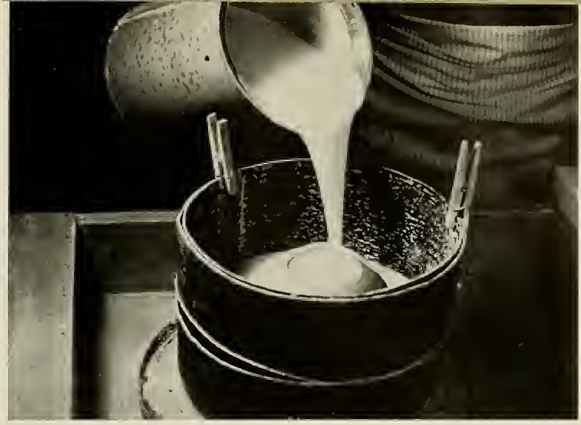
The original shape, called the "model," may be made of virtually any material. Plaster, wood, metal and clay are preferred, in that order, professionally. Few classrooms are equipped for the forming of models from turned plaster, wood or metal, so solid clay models are more common. Harder materials allow forms to be shaped more precisely, resulting in more perfect model surfaces. If a motorized potter's wheel is available, it can be adapted for turning plaster, as explained in the section on Draping on the Wheel. Clay, however, can be satisfactory if it is given its *final* surfacing when it has stiffened. Achieving a smooth, undimpled surface on a soft clay form is difficult.

The method of forming the clay model depends, again, upon the equipment available and the form desired. There is no limit to the types of shapes—round, square or free-form—as long as there are no reverse curves in the profiles or side views of the pieces. Such curves would form "undercuts," preventing the models—or the subsequent clay castings—releasing from one-piece molds.



MAKING A CLAY MODEL A throwing wheel is advantageous in the forming of a round model but even such a model *may* be formed free-hand. Having determined the design of the form, wedged clay is shaped on a wheel, a turntable, or—if other than a round form is desired—on the shiny side of a sheet of oilcloth. Metal, marble or glass are excellent surfaces on which to cast plaster.

The model is made upside down, so that when it is completed, plaster may be poured directly over it. A simple foot rim *may* be formed on the model, despite the fact that the inside of the eventually-cast clay form will exactly duplicate the outside. A depression around the *inside* of the cast form, above the foot, will result. The development of such an inside depression depends upon: the thickness and depth of the foot rim on the model, the character of the slip used in casting and the experience of the caster. The bases of beginners' models can be made flat or slightly concave, thus eliminating a foot rim.



MAKING THE MOLD A retaining collar or wall, called a "cottle," is used to confine the plaster when it is poured over the model. The cottle may be such that it will form a round mold, as shown here, in which case a strip of linoleum, roofing paper or even oiled cardboard may be used. If a square or rectangular mold is being made, pieces of oiled wood may be used. The round cottle is easier, in that it may be held firm and round with a cord tied around it, about half-way down. The cottle should be about 1″ away from the model. The angle formed between the outside of the cottle and the working surface should be sealed with clay. This not only prevents leaks but helps to insure against any pushing outward of the cottle by the often-unrealized pressure built up as the plaster is poured in.

If the model has been made of clay, no plaster separator is required. If it has been made of plaster, however, soaping is necessary.

When the model, cottle and clay seal have been prepared, the amount of plaster needed to fill the cottle to one or two inches above the model is computed. When the stirred plaster is ready, it is poured carefully into the cottle. Splashing and gurgling during pouring should be avoided, since such pouring could re-introduce air bubbles, the removal of which is a major part of the plaster-mixing process.

As the plaster sets, it will give off a considerable amount of heat, due to chemical reaction. When the setting plaster is warm to the hand, the sealing clay and cottle may be removed. The outside of the mold should be scraped smooth. While it is true that the *inside* surface of the mold is the important part, encouragement of good craftsmanship calls for all surfaces of the mold to be well finished.

The model may be removed immediately, although this will entail some digging if the model is of clay. The slip of a tool or gouging fingernails may mar the working surface of the mold. If the clay model remains in the mold overnight, or until it has undergone some shrinkage, it may usually be removed intact. Such clay will probably be moist enough so it can be returned to the clay storage container for future use, provided it is inspected carefully and all crumbs of plaster removed. Any excess clay remaining inside the mold should be removed with a damp sponge and the mold set aside to dry before it is used for slip casting.

CASTING SLIP Liquid clay is called "slip" but there are several types, useful in different ways. Slip intended for use in molds is referred to as "casting slip" and, professionally, the term means something more than a mixture of clay and water. It *is* possible, however, to use such a mixture and it may be considered as one of four ways of obtaining slip for casting. The other three ways are: (1) purchasing casting slip in the liquid state; (2) purchasing a prepared casting slip clay in the dry form; and (3) preparing a slip specifically for casting.

First, the purchase of ready-to-use casting slip is easiest for the classroom teacher. The slip merely needs to be agitated, without introducing air, and poured into the molds. Because it is the easiest—the work of preparation having been completed by the supplier—the purchase of liquid casting slip is also the most expensive. Depending upon the circumstances in the classroom and the amount of slip needed, however, the purchase may represent a saving.

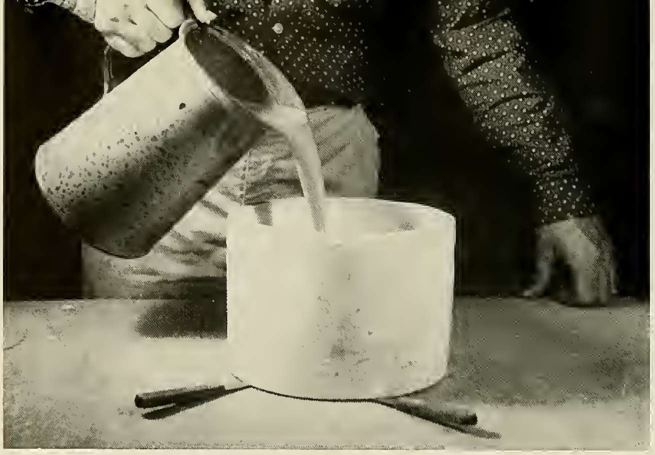
Second, the possibility of purchasing casting slip clay in the dry form may be considered. Some suppliers add one or more chemicals to their dry powdered casting clays or clay bodies. These additives are known as "deflocculents." Their presence decreases the amount of water which must be added to the clay to make it liquid and helps to keep the clay in suspension. These wetting agents offer a decided advantage, since the less water present, the shorter the casting time in the mold and the less the shrinkage of the cast form. The supplier will advise on the amount of water required per pound of clay to provide his product with its best casting properties. The cost of purchasing casting slip clay in the dry form is less than that of purchasing ready-to-use slip.

Third, a distinct saving may be realized if deflocculated casting slip is prepared in the classroom. This does not entail the purchasing of any large amount of material and does not require more space than does the adding of dry casting clay to water. Although there are a number of deflocculents, sodium silicate (purchased in liquid form and sometimes referred to as "water glass") is the most common and should suffice for classroom use. How the slip is prepared will depend upon the equipment available. Weighing the clay to be deflocculated and measuring or weighing the water and sodium silicate is advantageous. The amounts of water and deflocculent would have to be determined by testing and casting. In general, 35% to 40% of the weight of dry clay is the weight of water in pounds (1 pint = 1 pound). Approximately 0.3% sodium silicate is needed. If casting slip is to be prepared in this manner, the water is measured—warm or hot will mix more readily than cold—and the deflocculent added to it. The clay, added last, should be either new, in powdered form, or well-pulverized dry scrap. The slip will be very "heavy"—not easily stirred at first—but will become thinner with continued mixing. If it remains too heavy for use, *small* amounts of water may be added gradually, with a record kept of the total amount required, for later reference. The range between too little water and too much is very narrow. The slip should drain readily from the hand, indicating it will drain cleanly from molds, and, ideally, should "web" between the fingers when they are spread apart. If the fist is closed, then opened, there should be no apparent wateriness in the creases inside the fingers.

If scales and other measuring equipment are not available, casting slip may be deflocculated nonetheless. A *heavy* clay and water slip—one too thick to be poured—is prepared. A few drops of sodium silicate are added to the mixture, which is then agitated *thoroughly*. Vigorous mixing is required to disperse the deflocculent throughout. Although this method may not give results equal to the more controlled deflocculation, it will provide a slip which has a lower water content than would be possible without the sodium silicate and, in turn, slip which will cast more quickly, drain more cleanly and form cast pieces which may be removed from the molds more rapidly.

Some clays or clay bodies are more easily deflocculated than others. In general, the most plastic (finer-grained) clays do not deflocculate as readily as do the less plastic. If the clay being used in the classroom is "good" for general work, it may not be the best for deflocculation but, even so, it will be better for slip-casting if deflocculated. Many local or other red-burning low-temperature clays deflocculate very well.

Casting slips should be kept in covered containers, otherwise they tend to thicken and may develop thick crusts on top. They often need some agitation before use, preferably stirring by hand from the bottom up—so air will not be worked in—and screening. Containers being used to pour slip into molds should be clean and dry when slip is put in them.



CASTING WITH SLIP The mold is set on a level surface, or made level. The slip is poured into the mold from a pitcher for ease of handling and control of pouring speed. It should be poured evenly, with the initial stream directed to the bottom center of the mold. Slow pouring is not necessary: that the pouring be steady and even, without splashing—which could entrap air in the slip—is more important.

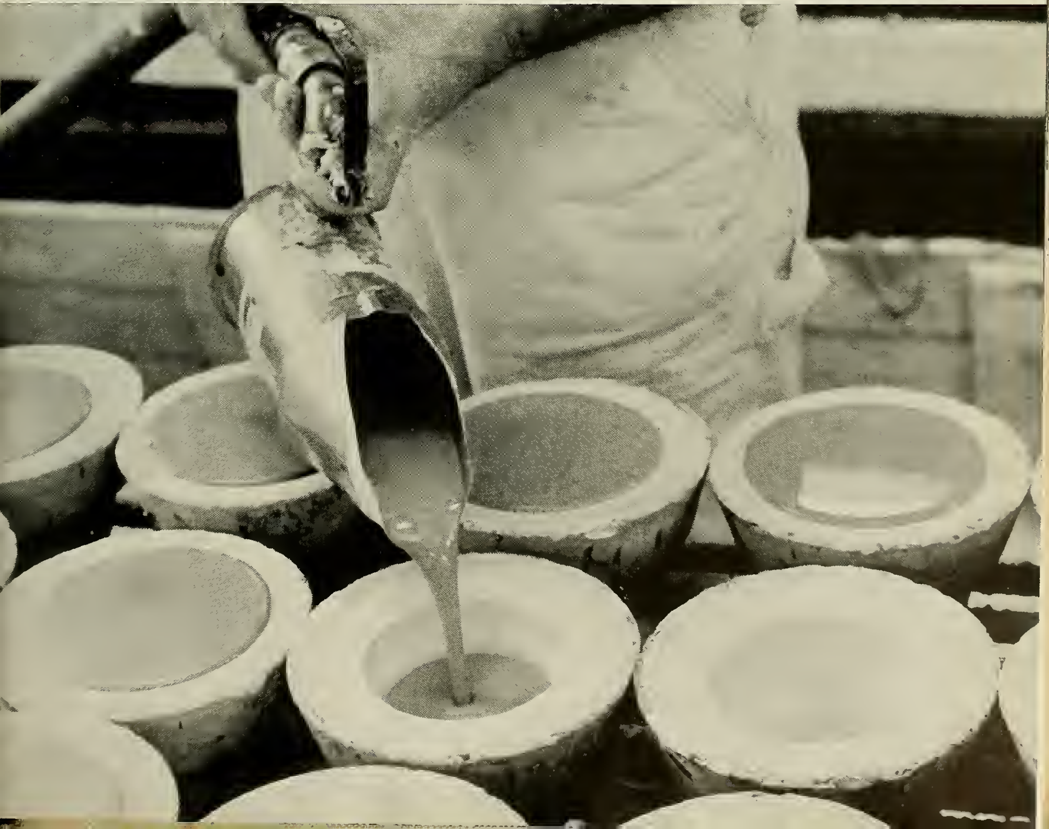
When the slip has reached the top of the mold, pouring is continued until a slight mound forms above the mold. Surface tension causes—and permits—a slight bulge above the level of the mold top.

The plaster mold will absorb water from the slip. How quickly will depend upon a number of factors, including: (1) the dryness of the mold; (2) the percentage of water in the slip; (3) the character of the clay being used; and (4) atmospheric conditions. As the water is absorbed, the level of the slip will lower. When this occurs, a little more slip may be added, until the level is again slightly above the top of the mold. While the slip remains in the mold, the plaster continues to draw water from it and wherever it is in contact with the plaster, a wall of moist clay is formed. The longer the slip remains in the mold, the thicker the wall becomes. When the wall is of the desired thickness, the mold should be picked up carefully and the excess slip poured off. Whether the mold should be turned upright or left upside down for further drainage depends upon several factors:

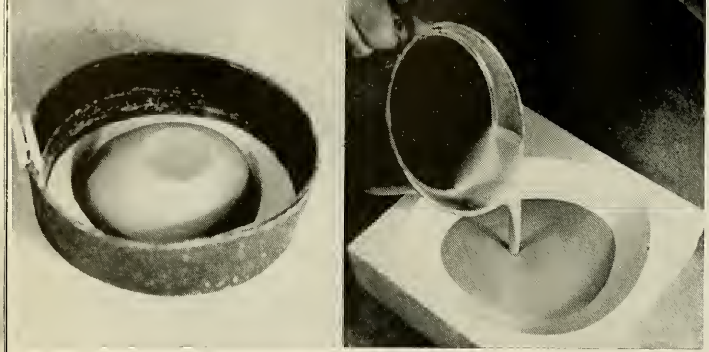
1. If the form has a foot rim and its corresponding depression on the inside bottom of the form is to be obliterated, the mold is turned upright, so that the small amount of liquid slip remaining will fill in the depression.
2. If there is no foot rim to be considered, the mold should remain upside down, *without* turning upright after pouring out the slip, until the shine has left the inner surface of the cast. When draining a mold in the inverted position, the cast is less apt to develop "tears" (bumps formed by undrained droplets of slip) on the interior surface if the draining is done at an angle rather than flat. The mold can be rested against one stick and the table surface. If the mold remains inverted too long, of course, the cast will begin to shrink away from the mold and *can* fall out.

When the interior shine has disappeared from the cast, the top edge of the form should be struck off level with the top of the mold. If this is not done, that portion of the mold over which the excess slip was poured will hold the clay more tightly than will the remainder of the top edge, thus causing warpage.

A cast made in a one-piece mold may remain in the mold indefinitely. The longer it remains, the more easily it may be handled in removal but it is likewise true that the longer it remains the less opportunity the mold has to dry for re-use. Students are always anxious to remove their casts, so as soon as the piece has shrunk away from the mold and seems entirely released, a plaster bat may be placed across the top of the mold and the whole inverted. The mold may then be lifted carefully away from the clay form, which remains on the bat for drying or until stiff enough for handling. The mold may be re-used at once unless it is quite wet from previous castings.



Courtesy Gladding, McBean & Co.



MOLDS for slip casting may be either round or square on the outside. Theoretically, a round form—or one more or less so—calls for a round mold, so that the mass of plaster will be somewhat evenly distributed around the form being cast, resulting in an even absorption of water and even walls in the cast piece. Considering the small number of casts made in any one classroom mold, the choice of a round or square mold may be determined by the equipment at hand. Whereas the round mold requires a flexible cottle, the square mold can be achieved by simply setting the clay model, upside down, in a cardboard box and pouring plaster over it.

CAST FORMS may be more easily "trimmed" (finished) when they have dried. Pieces from one-piece molds need only to have their rims rounded. No flat surface should remain on the rim top. This may be accomplished by one of several methods. The form may be rubbed on a piece of window screening, to level top and bottom, and a dry "rubber scrubber" (abrasive one side, sponge rubber on the other) can be used to work down sharp edges, both inside and out, followed by a simple sponging. A second method, which assures a perfectly level top edge, involves a small puddle of water on a clean, non-absorptive surface. This may be a glass slab, a piece of marble or masonite. The form is inverted into the puddle and moved around with a circular motion. This action must be continuous, once the form is on the flat surface: if it is not, the form will attach itself firmly to the work surface. Within seconds, the form may be turned upright in one hand while the other sponges the edges, rounding the rim to remove any metallic or wooden characteristics.

SURFACE ENRICHMENT

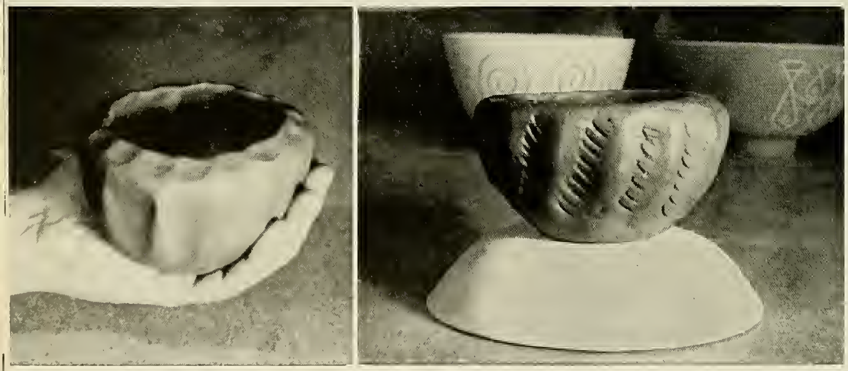
Metcalf Elementary School, Normal, Illinois

The earliest form of surface enrichment on clay shapes was undoubtedly accidental. Clay bowls discovered on the sites of prehistoric Swiss lake villages were found to have marks of basketry on the outsides, implying that the bowls were shaped by smearing clay on the insides of baskets, then burning away the baskets in the process of firing the pottery.

When man began decorating clay objects consciously, probably at a very early stage in the history of pottery-making, his first tools were his fingers or crude sticks. The decorations were simple stripes or cross-hatchings, reminiscent of his earlier pieces made within baskets. Later the effects grew in complexity through the use of variously colored clays, applied in strong contrast to the colors of the clay pieces themselves.

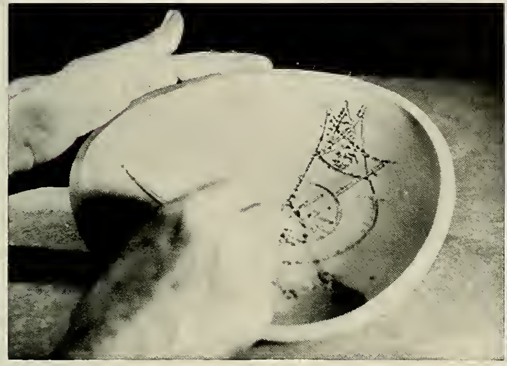
With the discovery and use of glazes, further surface enrichment and more sophistication were possible but for thousands of years pottery decoration depended on either colored clays—slip decoration—or on pressing and incising. These methods are widely used in contemporary studio pottery, offering as they do direct and forceful treatments on damp or leather-hard clay.

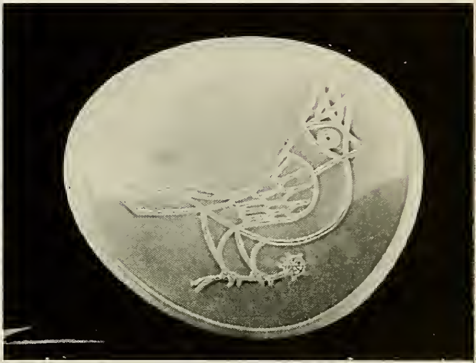
Surface treatments which can be carried out on damp or leather-hard clay are especially appropriate for either young students or beginning pottery students of all ages. The sense of action, originating with the making of a form, carries forward without a lapse of time, as happens when decoration is withheld until the form has been bisqued.



DECORATING WITH THE FINGERS A natural result of shaping a pinch pot is the forming of vertical or spiraling finger grooves on the outside. These, in themselves, constitute a simple form of decoration. Pinching the top edge of a bowl with the finger tips will add a decorative touch to the rim. Fingernails can also be used to add texture to the surface.

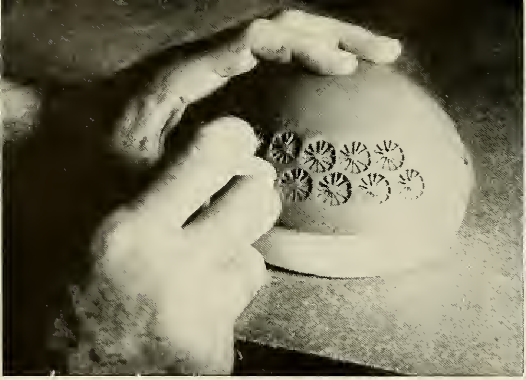
INCISING Incised designs are made by scraping a tool point across the surface of moist or leather-hard clay. Any fairly sharp tool that will cut a fine groove in the clay may be used. When a solid tool, such as a pointed dowel, is drawn across the surface, the clay pushed aside forms burrs. These are brushed off easily when the ware is dry and the glazed form shows a clean line. The eye of a darning needle will cut a clean line in leather-hard clay without the burrs; the excess clay passes through the eye of the needle. The point of the needle can be driven into a dowel for safety. Incised decoration is particularly effective on a light-burning clay because a colored transparent glaze may then be used and it will gain in brilliance where its thickness is greater—in the lines.

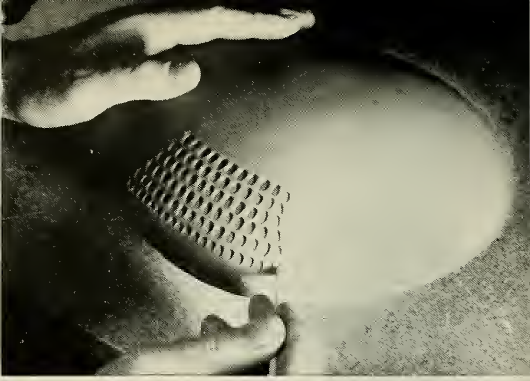




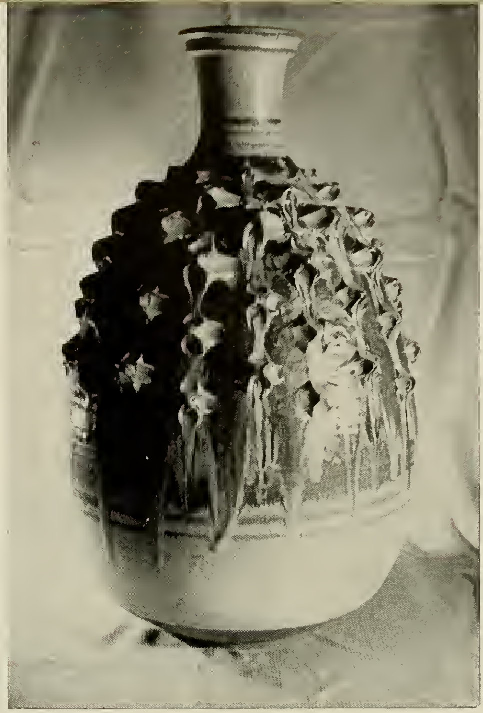
Although the complete planning of a ceramic piece ideally includes not only the form but the glaze and the decoration, if that is desired, beginners are not often capable of such a high degree of projection. They may, therefore, be urged to build their fund of ceramic knowledge by a number of decorative experiments, executed upon *simple forms*. The term "simple forms" is stressed because these offer the least limiting surfaces. The decoration has less tendency to become "tight" and overworked upon surfaces which are freely accessible, physically.

Beginning students will be disposed to drawing proposed decoration on their forms—regardless of the techniques they are planning to use. It *is* possible to do so—either with a lead pencil upon raw clay or bisque or with ink and brush on the same surfaces or upon a glazed, but unfired, surface. If the preliminary "drawing" is limited to the establishment of areas or the most general of directional lines, the students will become adept in decorating much more quickly than they will if permitted to "over-draw" in planning. They will be less inhibited, less worried about "missing" the drawn line by a fraction of an inch, less concerned about "perfect" execution. They will then be free to *utilize the tool and the medium*—be it engobe or majolica color—in "building up" the decorations in ways suitable to the expression of the *materials* being used. Encouraging decoration through this concept is not as easy for the teacher as it is to permit the execution of "pictures" or the "coloring in" of tightly-done preliminary drawings. Recompense will be found, however, in the more spontaneous, more "potterly" results. Finding out what the tool and the material will do can be a stimulating experience, if encouraged.





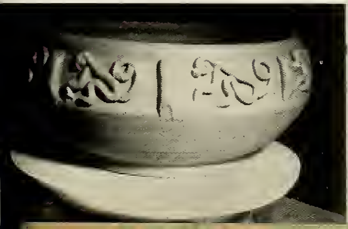
PRESSING or STAMPING Moist clay is so receptive to pressure that even the earliest potters were intrigued by the possibilities of pressed or stamped patterns. Students of all ages enjoy experimenting with "found" tools: sticks, tubing, modeling tools, nails, bolts, keys, type faces, screen wire, cloth, weathered wood, fingernail files and hairpins are but a few of the possible items. Stamps may be made from wood or plaster, illustrated here by a wooden dowel across which saw cuts have been made, resulting in a flower-like motif. A manicuring stick is being used to impress an over-all pattern on the form at the right. Stamps may also be formed of clay, bisqued before use. Pressed decorations are most effective when executed on fairly soft clay. The clay form, therefore, should be supported on the surface opposite that being stamped.

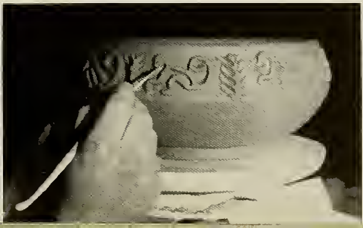


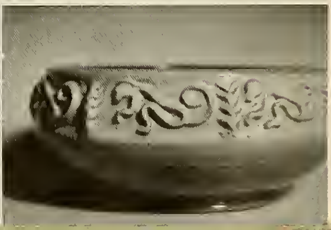
MODELING-ON Plastic clay may be applied to a damp clay form in any one of many ways. It is imporant that the form be damp—not yet leather-hard—because the applied decoration and the form must shrink together, to avoid the cracking away of the applied clay. If the form is leather-hard, or harder, it has undergone initial shrinkage; soft clay added to it has not. The two must be compatible, as to comparative degree of water present.

Thin coils of clay can be rolled out and applied in straight, wavy, spiral or circular lines to form a decoration. Small balls of clay can be applied in the same way to form either a definite pattern or an over-all pattern. Sometimes the balls of clay are pressed down firmly on one side and made to overlap, in the manner of fish scales. Sometimes they are pressed down evenly on all sides, using the thumb or a fingernail.

Slabs of clay can be cut into squares or triangles or used as they result from rolling. In all cases, the clay additions must be firmly adhered to the body. *Thick* slip used between the form and the applied clay will help, although students tend to regard it as a never-failing "paste" and expect too much of it. Slow drying will provide some assurance against cracking.







SLIP DECORATION is popular with most students. There are so many techniques in which colored slips are used that the classroom offering even a modest program in clay will benefit from a supply prepared for the use of all.

Every liquid clay is properly called "slip." Those liquid clays used specifically for decorating are usually designated as such or are referred to as "engobes." This term derived from "envelope," at a time when a contrasting slip was used to cover an entire form, with the intention of presenting a more pleasing appearance than did the coarser clay of which the form was made.

Engobes are available from suppliers and are not much more expensive than those prepared in the classroom. There are, however, four substantial reasons for students preparing engobes: the fun of experimentation—adding more or less colorant to a base slip; reasons of economy; the convenience of being able to prepare them quickly, when needed; and last—but perhaps most important—for the greater understanding of the materials used. Although it is very convenient to have row on row of commercially-available, ready-to-use engobes, underglazes and glazes in the classroom, all that is gained is convenience. Lost is not only understanding but appreciation of the knowledge and labor involved in the preparation of various materials.

The directions which follow for the preparation of decorating slips indicate the least complex method and the one requiring the least equipment and supplies. A white-firing clay or clay body will provide not only a white engobe but a base which will not affect—"grey down"—colorants added. If a white clay is not available, a buff-firing one may be used.

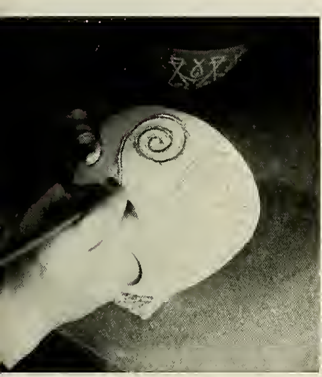
A gallon of white- or buff-firing slip is first prepared, then used to fill eight pint jars. Standard measuring spoons can be used to add the suggested amounts of oxides, labeling the jars accordingly. The following table is based on level spoon measurements per pint of liquid base slip:

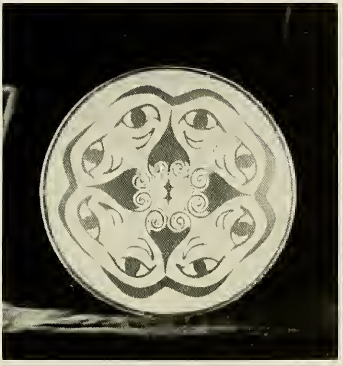
Light Blue . . .	¾	teaspoon cobalt (oxide or carbonate)
Medium Blue . .	1¼	teaspoons cobalt
Dark Blue . . .	2	teaspoons cobalt
Light Green . .	¼	teaspoon cobalt and ½ teaspoon chrome
Medium Green .	½	teaspoon cobalt and 1 teaspoon chrome
Dark Green . .	1	teaspoon cobalt and 2 teaspoons chrome
Pink	3	teaspoons iron oxide
Gray	¾	teaspoon cobalt and 2 teaspoons manganese
Beige	3	teaspoons manganese
Dark Brown . .	9	teaspoons manganese
Black	9	teaspoons manganese and 2 cobalt
Red-brown . .	8	teaspoons iron (or use a red-burning clay)

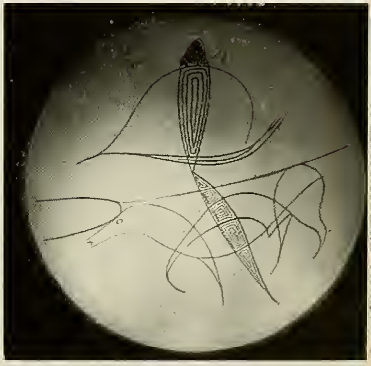
The amounts of oxides given are approximate, as the resulting fired colors will vary according to the type of clay body used in preparing the slips and the types of glazes used over them. The colorants should be well dispersed in the jars, by stirring or shaking. If a mortar and pestle are available, the color can be more thoroughly dispersed by a few minutes' grinding.

Engobes, either in the jars or after application and drying, do not indicate the colors that will develop after covering with glaze and firing. Even the bisque fire changes them very little. Their true brilliance will appear only after the final firing. For this reason, it is a good practice to have a fired, glazed test of each engobe fastened on or near its jar, so students can refer to it and thus realize the final color while applying engobe treatments.

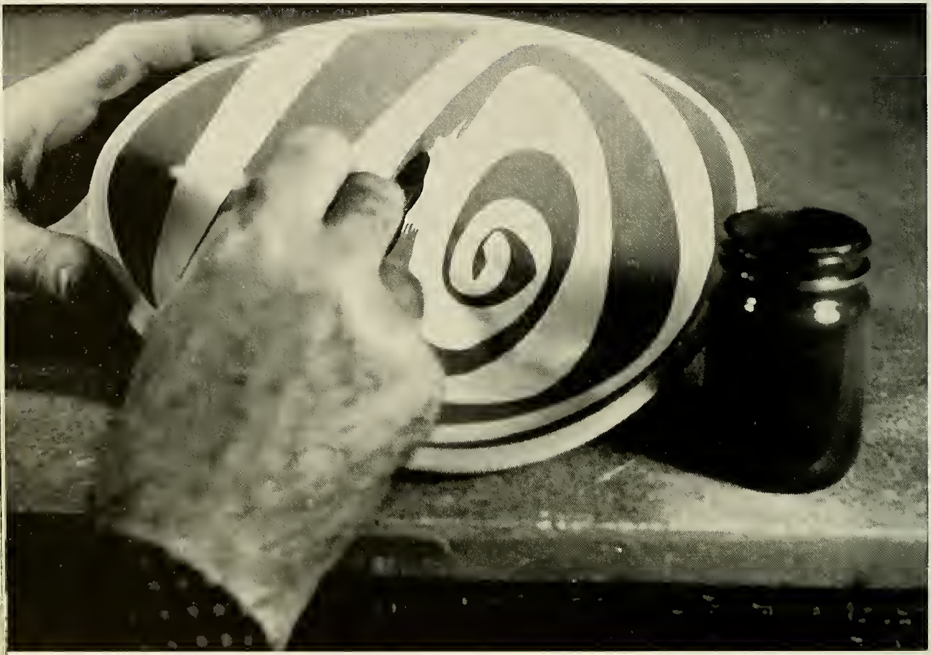
One advantage of some commercially-prepared engobes is that they are additionally colored with other than the metallic oxides, so the colors in the jars approximate the colors under fired glazes. Engobes may be prepared in the classroom with dry underglaze colors, rather than metallic oxides. The oxides, however, offer the least expensive solution to the problem of obtaining engobes.







SGRAFFITO One of the oldest methods of decorating clay, sgraffito depends for its effect on the use of a covering slip or engobe which is in strong value contrast to the clay body. Either black over white, white over red, or red over white would provide the desired degree of contrast. The slip is painted or sprayed over the entire surface of the piece, which may be leather-hard or dry. Spraying should not proceed too rapidly, especially on a dry, thin-walled piece: the sudden absorption of water from the engobe by the walls could lead to cracking. When the slip dries, which usually requires but a few minutes, a sharp tool is used to scratch a design through the coating to the body beneath. As in the process of incising, burrs are created by the cutting but they brush off readily when the sgraffito process is complete. The two plates illustrate the use of black slip on white clay and white slip on red clay, respectively.



SLIP PAINTING Designs for slip painting should be bold rather than delicate, for both aesthetic and technical reasons. A thin application may be partially dissolved if a transparent glaze is used over it. A very thick coating may crack or even peel off the ware, although appearing "perfect" just after application. The engobe, therefore, should be neither watery nor paste-like. It should be applied with a fully-charged brush and in successive thin coats—as opposed to single-stroke, built-up brush patterns—if areas are to be covered. Slip painting may be combined with sgraffito; some of the painted areas can be scratched through to provide more intricate designs. Although transparent glazes are often used over slip painting, semi-opaque and even mat glazes will afford less harsh and more intriguing results.

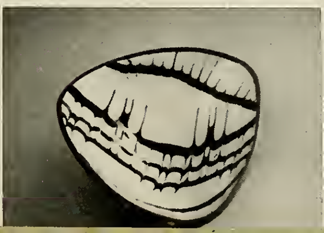
SLIP TRAILING An engobe decorating method so simple that children from the third grade up can use it, slip trailing requires a rubber ear syringe or a plastic squeeze bottle, such as those used for catsup. The syringe is a bit more responsive to the touch but empty squeeze bottles are cheaper. Slip for trailing should not be thin, as it will spread out or run when applied to the clay form. Although beginners will not be too precise with this technique, they often achieve bold and dashing effects. More advanced students will be able to execute fairly intricate patterns, searching about for "tools" which will provide openings of various sizes and, hence, raised lines of various thicknesses and widths.

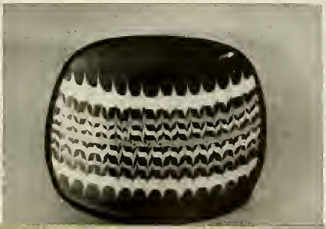
SLIP COMBING Slip combing is a technique which can combine a number of skills. It is more suitable for advanced students than for beginners because it requires both patience and practice. Combing may be carried out in two major ways: on flat or almost flat forms, such as plates or tiles, and on clay slabs to be used for subsequent draping. The former is less time-consuming but more difficult to control. In either case, the surface to be decorated is flooded with decorating slip. This is usually accomplished by holding the form or slab at an angle and pouring the engobe over it.

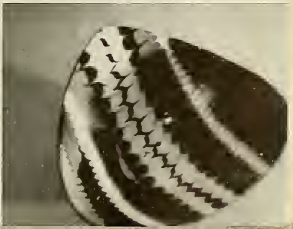
Lines of one or more engobes of contrasting colors are immediately trailed onto the wet, flooded surface. These are usually straight lines—easiest to execute—but on circular forms, such as plates, they are often done on a whirler, resulting in concentric circles.

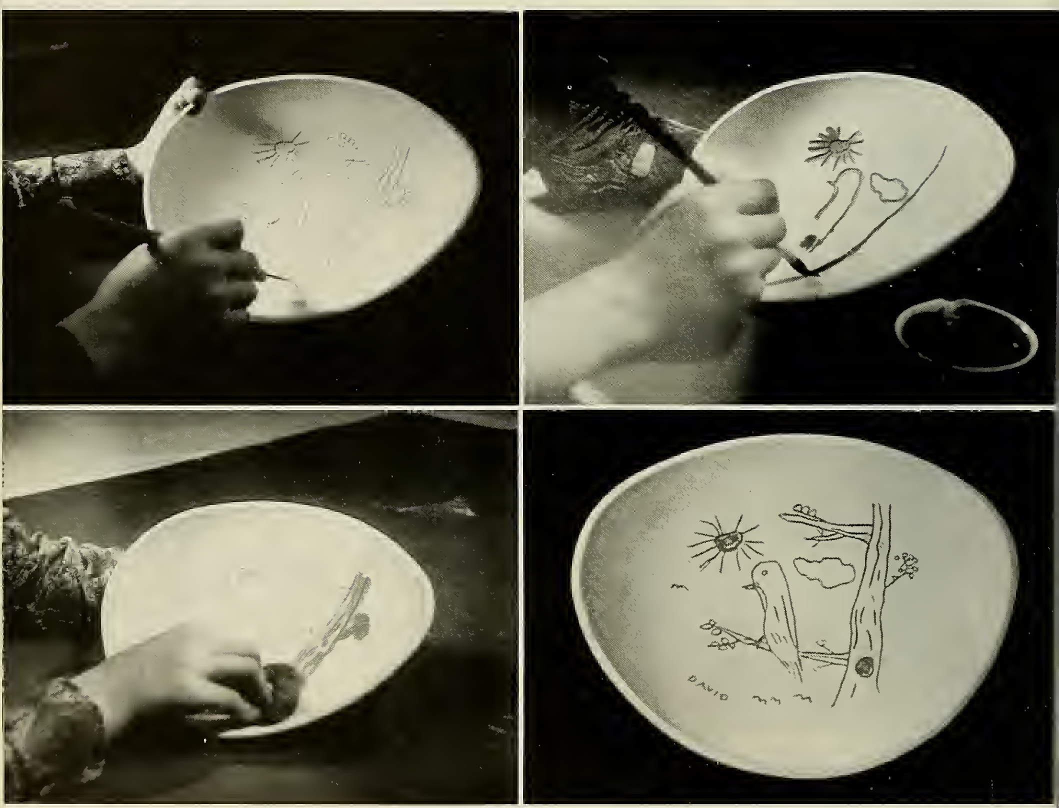
While the slips are still wet and shiny, a comb from which some teeth have been removed—so that only every third, fourth or fifth remains—is drawn lightly across the surface, usually at right angles to the trailed lines.

More complex patterns can be achieved by drawing the comb across a second time, parallel to the first draw but in the opposite direction and with the teeth set to produce equidistant spacing. When this technique is executed on a flat slab, to be given form by draping over a hump, the engobe decoration must dry sufficiently, so it is not tacky, before draping. The slab must not dry too much, however, or it will be impossible to form it over any but the most shallow hump.

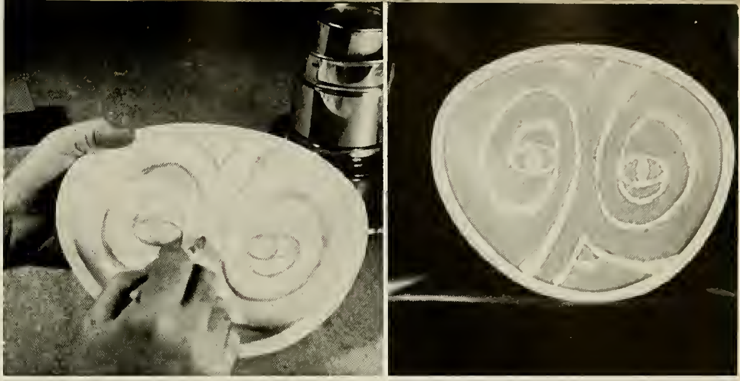






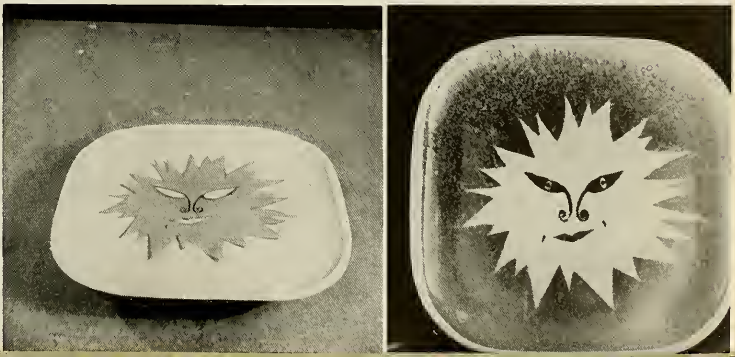


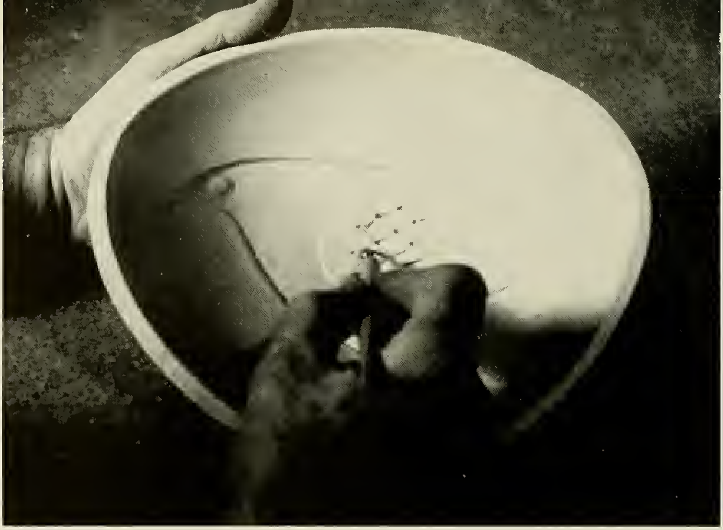
MISHIMA or INLAY This ancient Korean method of decorating permits great precision. The opposite of sgraffito, mishima consists of scratching or engraving lines in leather-hard or dry clay, the former being easier. The v-shaped valleys are then filled to overflowing with a slip, the color of which is in contrast to the body of the ware. When the slip is dry, the excess remaining on the surface should be removed with a scraper or a pad of fine steel wool, leaving the lines sharp and clear. A wet—or even damp—sponge should not be used to wipe over the design, for this will smear the engobe onto the surface of the form. Engobe in various colors may be used for the inlaying.



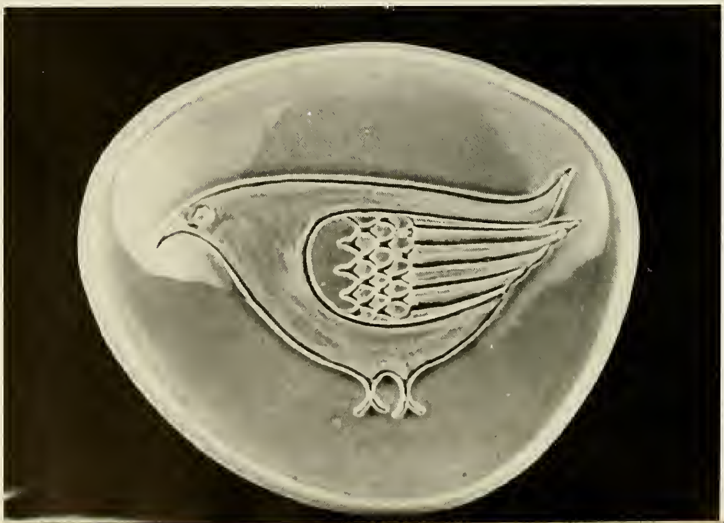
WAX RESIST WITH SLIP Waxes for resist methods of decoration may be either purchased in liquid form or liquified in the classroom. The above illustration shows the latter: beeswax is being melted on a hot plate in a simple double boiler consisting of a large tin can ⅓ filled with water and a smaller can, with the wax in it, floating in the larger can. The molten wax is painted on the raw clay surface. When the design is complete, colored slip is brushed or sprayed over it. The wax will burn away in the bisque firing, retaining the design in the color of the clay body. The finished piece shown here has been glazed with a mat glaze which is partially opaque, permitting the design to show through yet softening the total effect. Another resist medium is provided by ordinary wax crayons, which may be used on raw clay or bisque in the same manner as the liquid wax. "Ceremul A" and "Mobilcer C" are commercially prepared wax emulsions.

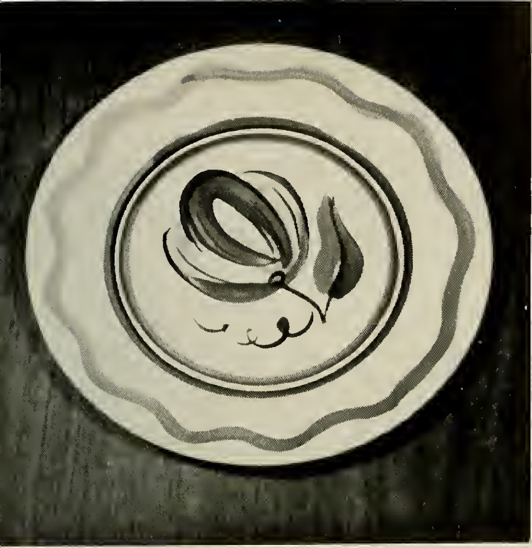
SLIP STENCILING The use of the stencil in combination with sprayed or spattered engobes is similar to all stencil methods. Patterns are cut from paper toweling, wet thoroughly and applied to a dry or almost dry clay piece. Spraying must be done as soon as the wet stencils are applied, since they dry rather quickly and may fall off before the spraying is started. Stenciling is not as direct a method of slip decoration as are sgraffito, slip painting and trailing. By comparison, it seems a forced method and care must be taken that it is not overdone in the classroom.

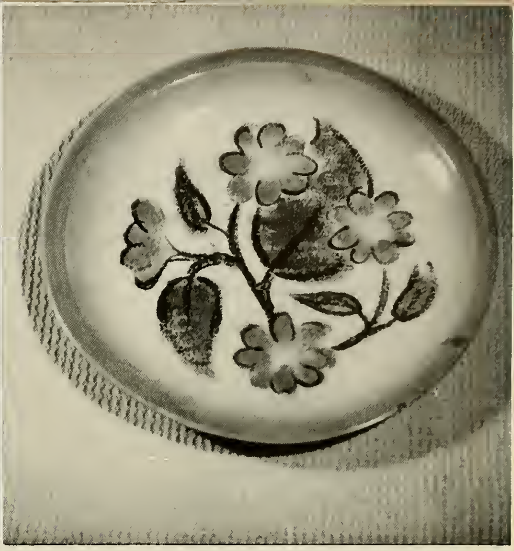




CARVING Carving may be most readily accomplished on clay which is leather-hard. It can be done on dry clay but the resistance to the tool is greater and chipping is more likely to occur. Low relief carving is preferable because high relief tends to make the surface of the clay form over-active, if not visually destroy the form itself. Here, the body form of the bird has been cut into the bowl surface, while the wing remains at the original surface level. The background could, likewise, have been cut away around the bird's body, providing a different effect. Carved designs show up well if the clay body is light-burning and covered with a colored, transparent glaze, illustrated here. If the clay body is dark-burning, a semi-opaque semi-mat or mat glaze will provide a good effect, becoming a bit heavier and more opaque in the depressions.







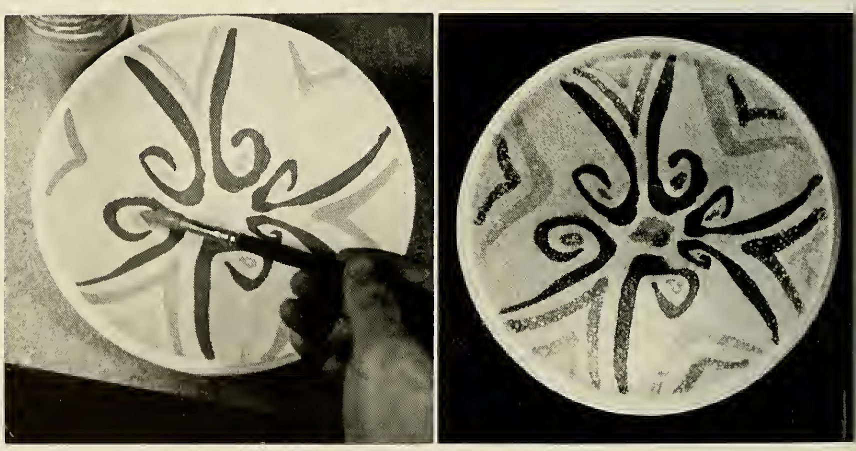
UNDERGLAZE Underglaze colors are available in a wide range of colors and are more brilliant under glazes than are colored slips. They may be purchased from ceramic suppliers and may be obtained in five forms: dry powder; moist, ready-to-use; semi-moist, in pans; crayons; and pencils. If purchased in dry form, the colors must be mixed with water, a few drops of glycerine or gum solution to aid in brushability and, if desired, a small amount of frit or transparent glaze to act as a binder in firing.

The examples above show underglaze painting, left, and underglaze crayon, right. Students tend to become a bit "tight" and to consider their work "precious" when decorating with underglaze media. If a freely-done animal or human figure, for example, is to be decorated with underglaze, then a tendency to portray features realistically often destroys the simplicity and unity of the form. Underglaze decoration is usually carried out on plates, bowls and similar shapes, where the precisely-planned drawing of "pictures" should be discouraged. Such problems will be less pronounced, however, if methods of decoration utilizing the clay itself, or engobes, precede the learning of underglaze techniques.

Advanced students can be encouraged to paint freely, using full-bodied brushes of medium-to-large sizes, in patterns built up of brush strokes or in banding. The decoration may be carried out on either dry clay or bisque. Although the latter is more usual, each has its advantages. If the work is done on raw clay, errors may be readily scraped and sponged away but the decoration is easily smudged—not only before bisquing but afterward as well. This presents problems in handling for the initial firing and in glazing—particularly if the form is such that the interior must be glazed by pouring the glaze in and out. If the decoration is executed on the bisqued surface, any erasure short of a thorough scrubbing is ineffective but the glazing may proceed without an intervening firing. In fact, in the case of a closed bisqued form, the interior may be glazed *before* the underglaze decoration is carried out, so the piece needs but little handling after decorating.

MAJOLICA A piece of bisqued ware is glazed with an opaque, usually glossy and light-colored glaze and majolica colors are painted on the surface of the glaze before it is put in the kiln. The decorating colors are actually glazes, heavily charged with color. They are prepared by mixing 75% dry base glaze or a frit (such as Ferro Frit No. 3195) and 25% dry underglaze color or metallic oxide (such as Copper Carbonate). Small amounts of decorating color go a long way, so jars of prepared majolica colors kept on hand for all students will provide a saving in materials. If each student prepares the colors as he needs them, there will be more waste. He will invariably prepare more than he needs.

Majolica decoration should be very direct and spontaneous, using a fully-charged, soft brush. Because the decorating colors are strong, single brush-stroke patterns, with a "dry brush" technique at the ends of the various strokes, serve to permit the underlying base glaze to lighten and soften them. Filling-in areas of color should be discouraged in favor of freely-executed brush work, employing full-arm movement. If the color is built up by over-painting or is otherwise too thick, the decoration may not fuse into the base glaze as it should, resulting in a dry, sandy surface.

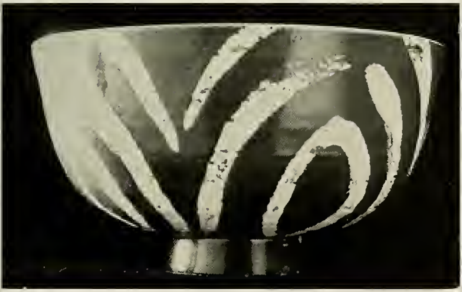


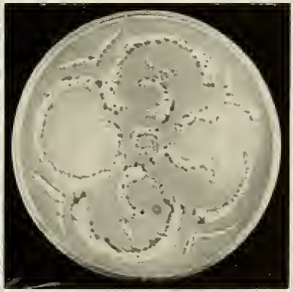
Decorating on *fired* glazed surfaces can be carried out through a number of methods. These represent possibilities for advanced students although even such students will be well advised to strengthen their skills in the more basic, integral methods of surface enrichment, which lend themselves to sophistication no less than to simplicity. Among the treatments for fired glazed surfaces, however, are glaze sgraffito, glaze stencil and overglaze decoration.

Glaze sgraffito is similar to engobe sgraffito. A second coating of glaze in a contrasting color—dark blue over light blue, for example—is applied on a piece of glazed and fired pottery. Dark colors over light colors usually provide better results than do light over dark. While the second coating of glaze is still damp, a design is scratched through to the fired glaze, using a blunt tool such as the end of a brush handle. Sgraffito involving glazes is not as controlled a technique as that involving slip, because triangles of glaze tend to flake away when one line is scratched at right angles to another.

The same stencil method used with engobes may be used with glazes. The stencils are cut from paper towels, wet with water and adhered to the glazed surface. A glaze of a contrasting color is sprayed or spattered against the edges of the stencil patterns or over the entire unprotected surface of the piece. As soon as the glaze coating has dried, the stencils can be lifted off gently or will fall away of their own accord.

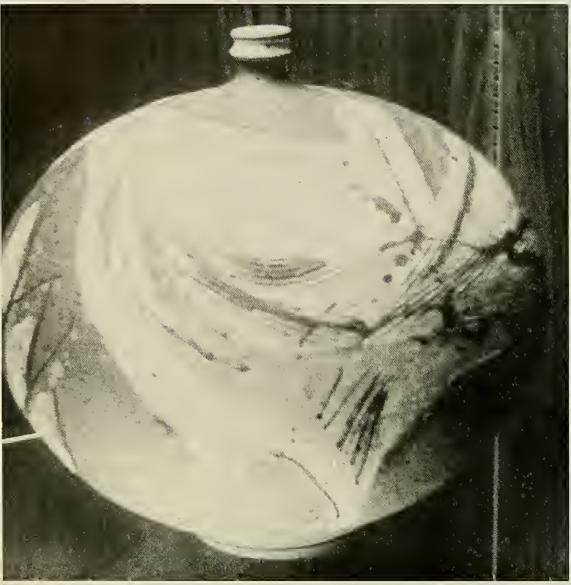
Special colors for overglaze decoration, to be executed on fired, glazed surfaces only, may be purchased in either dry or ready-to-use form. They are ceramic colors, very similar to those used in enameling on metal, designed to fuse to a glass at a low temperature, about 1400°F. At this temperature range, they will fuse to a glazed surface. As with underglaze colors, the temptation to paint pictures on the ware should be avoided. The colors can be used for free-brush patterns and banding. The gold or platinum bands often seen on dinnerware—or on imported dime-store trivia—are applied as overglazes. A restrained use of the brilliant effects possible with overglaze colors can be most effective. Unfortunately the use is most often abused and unrestrained.



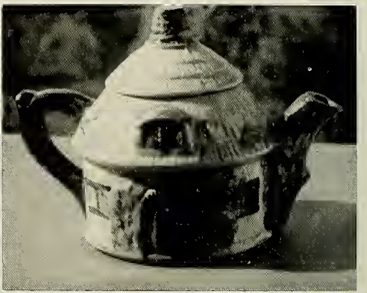


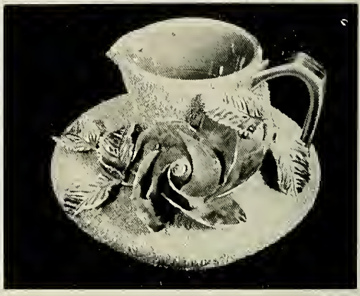
GLAZE RESIST Wax resists may be used in several ways in conjunction with glazes of contrasting values. Melted beeswax, paraffin, or commercially-available wax emulsions, such as "Ceremul A," may be purchased. The resist technique may be used on forms which have been glaze-fired, as it was on the bowls illustrated here. Following the application and drying of brush-stroke patterns in wax, contrasting glazes were applied. The wax burned out in the refiring, leaving a light pattern against the dark background, at the same time providing an unusual textural effect.

The same technique may be used on an *unfired* glazed surface, using a dark glaze over a light one or the reverse. Wax may also be used to cover completely a glazed *unfired piece*, after which a line design is cut through to the bisque. A glaze of contrasting value is then brushed repeatedly over the entire surface of the piece. It is repelled by the wax but builds up in the line pattern (not unlike the mishima technique employing engobes). When glaze-fired, the lines of the pattern will soften and fuse in with the base glaze, providing both texture and pattern.



Courtesy Krannert Art Museum,
University of Illinois





What stronger argument could be made for simplicity in form and bold suitability of surface enrichment than in the examples shown here? The vase, by Ralph Baccerra of California, is decorated with incised lines and engobes. The quality of the clay from which the vase was thrown is not lost; the final treatment reaffirms it.

The teapot and pitcher serve as fine examples of what *not* to do with clay. The teapot lacks good functional qualities—even if the inappropriate form could be overlooked. The lid does not fit the form securely and the knob is so shaped that it does not afford a good grip. A teapot should fulfill these functions, as well as others. Above all, it should state "teapot," not "cottage."

The textured exterior surface of the pitcher is unpleasant to the touch and would not prove sanitary in the event of dribbling. The rose petals and leaves are knife-edged and much too fragile for practicability. Decoration should not become more important than the form upon which it is placed. It should enhance, not destroy, the form.

The various means of surface enrichment stressed on the preceding pages are those suitable for beginners. They are traditional and innumerable variations of each will be discovered by advanced students, provided their ceramic knowledge includes experience with the basic techniques.

CERAMIC JEWELRY

Metcalf School Normal, Illinois

Ceramic jewelry is an ideal clay project for the art teacher or classroom teacher who has a minimum of equipment and budget for clay work. A small kiln, costing about seventy-five dollars, is large enough for two or three dozen pieces in one firing. Small amounts of clay and glaze are required. White-firing clay has the advantage of giving colored transparent glazes more brilliancy but if a darker-firing clay is being used and the whiteness under transparents is desired, a white engobe will provide the same general effect. Red-burning clays can also be very effective, utilizing semi-transparent or mat glazes, depending on the decorative technique being employed.

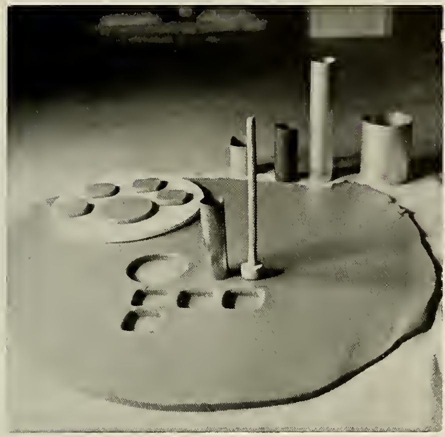
How "ideal" the jewelry project may be—aside from the limited equipment and materials required—depends completely upon the control of the preconceived notions with which students approach the problem. The popular concept of jewelry, in general, tends toward an ornate quality. Ceramic jewelry, specifically, is often considered *only* in terms of paper-thin flowers, complete with petals, stamens and leaves, reproduced as faithfully as possible. The popularity and abundance of floral ceramic jewelry in the market place are facts against which the teacher needs to be prepared. If the project is presented in such a way as to encourage direct statements in the material, completely overlooking the possibility of three-dimensional floral "design," students can be persuaded toward a deeper art philosophy.

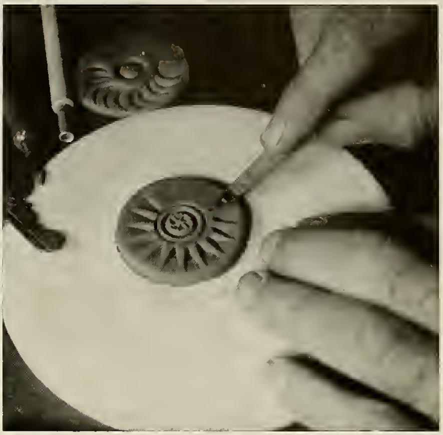
Restraint in the design of ceramic jewelry needs to be accompanied by restraint in the amount of material used. Fired clay is not a particularly lightweight material, so pieces should be as thin as practicable and have a certain delicacy. How delicate will depend on the age level and ability of the child making them, but certainly delicacy should be one aim of the problem. Pieces may be thinned, after drying, by rubbing the backs on a small piece of window screening or sandpaper.

Stamping or pressing are but two of the many decorative techniques suitable for ceramic jewelry. The forms may be flat and decorated with either engobes or underglazes.

The simplest way to apply glaze to ceramic jewelry is by brush. Pieces decorated with engobe or underglaze should be bisque-fired first, otherwise the glaze-brushing may disturb the decoration. Other pieces, such as those with stamped designs or carving, may be single-fired, with the glaze applied directly to the raw clay. Colored transparent glazes are particularly effective on carved or pressed designs, the color deepening in the depressions and serving to enhance the three-dimensional quality.

Findings, such as pin and earring backs, plastic earring clips and jump rings, can be purchased from local hobby shops or craft supply houses. They are not expensive and can be attached to the unglazed backs of fired pieces with liberal applications of china cement. An adequate amount of fresh—not thick—cement is placed on the back of the form and a small amount on top of the pin back as well, so it will be embedded in the cement. When the pin back has been applied in the desired position, it should not be moved, as this could break the adhesive quality of the cement. At least one hour should be allowed for drying.

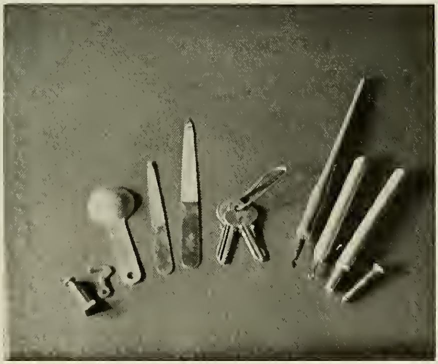


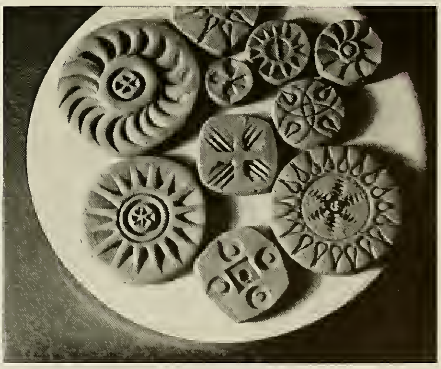


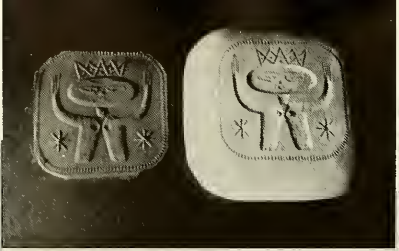
Pieces of tubing, round or square, can be used to punch out shapes for pins, buttons, earrings and pendants. A slab of clay is rolled out to about one-quarter inch in thickness. The clay may stick to the inside of the tube after cutting: pieces of doweling or plaster plugs can be used as pushers to eject it. If no tubing is available, shapes of all types can be cut out from the slab with a knife.

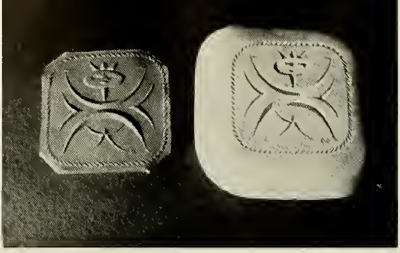
As soon as the pieces have been formed, designs can be pressed into them with either "found" items or the customary ceramic tools. A wide variety of effects can be obtained with the most simple tools and the necessity of determining the pattern *through* the tools provides a valuable lesson in design. The trimming and sponging of edges is most easily done after the forms have dried.

As an alternate technique, the shapes cut from the clay slab may be allowed to dry until leather-hard, then carved. They can also be carved when completely dry, although chipping may prove a problem.



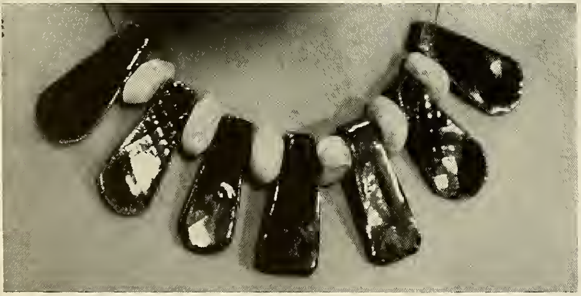






Plaster molds of various types may be made for ceramic jewelry. The clay is usually pressed onto or into the plaster, although pressing the plaster into the clay is also possible. A design may be carved with a sharp tool into a small piece of dry plaster. Moist clay can then be pressed onto it and a raised design will be formed on the clay surface. Trimming the edges of the small clay slab, so that the perimeter relates to the pressed design, can be done more easily after the clay has stiffened but is not yet dry.

A mold of another type can be made from a clay model. Clay is shaped to form the desired object and finished as finely as possible. The clay model should have no undercuts—that is, no parts tapering inward and downward when face up. The finished model is placed face up in a box lid or other container and plaster is cast over it. When the plaster has hardened the model may be removed. When the plaster mold has dried, moist clay may be pressed into it, reproducing the model exactly. An advantage of press molds for ceramic jewelry is the sharp, clear reproduction that is possible. A disadvantage is the temptation to over-produce a single form, leaving other designs and techniques unexplored.



A fifth grader made the above necklace in red clay. Forming holes in beads and buttons can best be accomplished when the clay is leather-hard. If it is done while the clay is soft, there is some possibility that the holes will close as the piercing instrument is removed or through unintentional pinching. A drill point, held between the fingers and rotated, will cut a clean hole in leather-hard clay. Since the openings will become smaller as the clay shrinks, they should not be made too small or the passing of a needle or thong through them later may be impossible. Another reason for sizable openings is the probability that some glaze may flow toward them, thereby decreasing their sizes. Glaze must be thoroughly scraped out of the openings after application. A wet pointed brush, twirled in each opening after scraping, will act as a further precaution against filling with glaze during firing.

CERAMIC SCULPTURE

Ever since man began to make objects from clay, thousands of years ago, ceramic sculpture has been a favorite means of artistic expression. Museums exhibit the wonderful clay animals and figures of ancient Egypt, the horses and riders of Crete, the Tanagra figurines of Greece and the work of the ancient Mexican and Peruvian sculptors.

As a method of creative expression in the classroom, clay sculpture bows to no other medium. There are many ways of working with clay to create ceramic sculpture, from the simple push-pull method to the complex hollow-built methods.

Almost any clay or clay body can be used for ceramic sculpture, although a body prepared specifically for the purpose, sold as "Terra Cotta Clay" or "Sculpture Clay" is advantageous. These bodies contain large amounts of grog—crushed, fired clay—which facilitates stiffening during building and easier drying and firing, with less cracking. In addition, the texture of the fired clay is peculiarly suitable for sculpture. Lacking a prepared sculpture body, the clay ordinarily in use in the classroom can have the same qualities through the simple addition of grog, purchased from a ceramic supplier or prepared by crushing lightweight insulating brick, which can be wedged into the clay. Dampening the grog before wedging will prevent the clay from becoming stiff, as the grog will pull moisture from the clay otherwise.

Children in the lower grades do not usually need outside priming as to inspiration. At those ages, they are naturally ingenious at developing form. Children in the upper grades may need some inspiration, however, and the rule-of-thumb in this respect is to suggest to them that they make figures or animals that are familiar to them, although if they want to make hippopotami, let them. A trip to the farm or the zoo will give them plenty of inspiration for animal sculpture, and most of them will have pets they may use as subjects. If no farm, zoo or pets are available, a comprehensive, well-illustrated book on animals may be at hand in the classroom: Hegner's *The Parade of the Animal Kingdom* is excellent.

Children's sculpture often has more charm if the honest finger marks of creation are retained, as opposed to smoothing them away with an overuse of water. Water, in fact, should not enter into the making of a piece of ceramic sculpture. It may, however, be used to achieve texture on a finished form which has been made from grogged clay. Rubbing the piece with a wet sponge will wash away some of the surface clay, leaving particles of grog protruding. If the clay surface is smooth, clay pellets can be pressed together closely to form an over-all texture or a scrub brush can be pressed against the moist clay to provide a coarse texture. Various tools, such as the end of a piece of tubing, can be used to form a textured pattern. Texturing will be more effective if it is used with some restraint, contrasting with smooth surfaces. A number of textural effects on one small piece could become overpowering.

Slip decoration or majolica decoration can often add to the charm of ceramic sculpture. "William," the famous little hippo of the Metropolitan's Egyptian collection, is a case in point. He is decorated with lotus blossoms under a blue glaze. Decoration that seems natural to the piece is most logical: stripes on a cat, tiger or zebra, spots on a leopard and scales on a fish—even lotus blossoms on a hippo.

If the clay, fired to its maturing temperature—not merely to a lower-fire bisque—is of a pleasing color, ceramic sculptures without glaze may be desired. Clay fired to its maturing temperature should be dense but if it is not, the pieces may be protected from eventual ingrained dust or dirt by applying a coat of wax. Wax, in the form of paste shoe polish, can be used to stain, as well as protect, the surface, should the fired clay color be anemic.

When glazes are to be used on ceramic sculpture, mat or semi-mat glazes may be preferable to shiny surfaces. Light reflections from a glossy glaze on the undulating surfaces of ceramic sculpture tend to detract from—if not actually deform, visually—the work. Some sculptors, who use clays firing a warm terra cotta color, often glaze only parts of the work—hair and garments, for example—providing contrast in color, texture and reflective quality with the clay.

Thaddeus Stevens School
Pittsburgh, Pa.

HOLLOW-BUILDING Ceramic sculpture may be built from a grogged body or clay simply by using small amounts, pressing them together to form the walls of a hollow shape, starting at the bottom and building up toward the top. The clay may be used in bits and pieces or in coils. When made in this fashion, the piece will be hollow when completed, so no later hollowing-out will be necessary.

A second method of building, also resulting in an interior cavity without hollowing-out, is the paper core method. This is a good method for animal banks, which children find interesting ceramic sculpture projects. A ball or egg-shape of tightly wadded newspaper is made first, then covered with moist clay to form the body of the piece. Details such as head, legs and tail can then be added to complete the figure. The clay for this method should be quite moist. When the piece is leather-hard, a coin slot can be cut in, cutting down to the paper wad and making the slot wide enough so coins can be shaken out. Forms made by this method must be dried thoroughly, until there is no possibility of dampness in the paper. During the firing the paper will burn away. Chickens, dogs, cats and plump figures, as well as the inevitable pigs, and other subjects familiar to children are appropriate for this method.

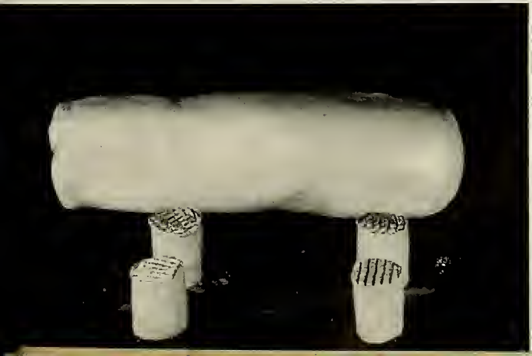
PUSH-PULL METHOD Students at all levels utilize this method of forming ceramic sculpture. It is the least complex of all, limited primarily to the material, clay, and the tool, the hand. Aside from occasional suggestions as to subject matter, children may be left on their own and they will proceed quite naturally to squeeze, push, pull and twist the clay. Students should be encouraged to sculpture either people or animals—as opposed to cottages, boats, cars and airplanes, for example. The multiple positionings and turnings possible in human and animal forms, their very organic natures, help to foster some feeling for composition. The same can not be said of static or mechanical objects. Forms in the primary grades should be small enough so that no hollowing-out is necessary. Middle-graders and above, making larger pieces, should hollow-out.

Large sculptures in solid clay present the problem of supporting the work in progress. The piece, if it is an essentially vertical form, may be temporarily supported by a smooth dowel or piece of broomstick, wrapped with several paper towels, around which the form is built. When the clay has stiffened sufficiently, the rod can be pulled out gently. It can not remain in place too long because the clay will begin to crack as it shrinks around the support. A second possibility is to start the standing figure in a horizontal position, standing it upright when the clay has stiffened enough so that it will not slump but before completely stiff. Large animal forms can be supported while working by propping their middles up with columns of moist clay.

Longan School, Kansas City

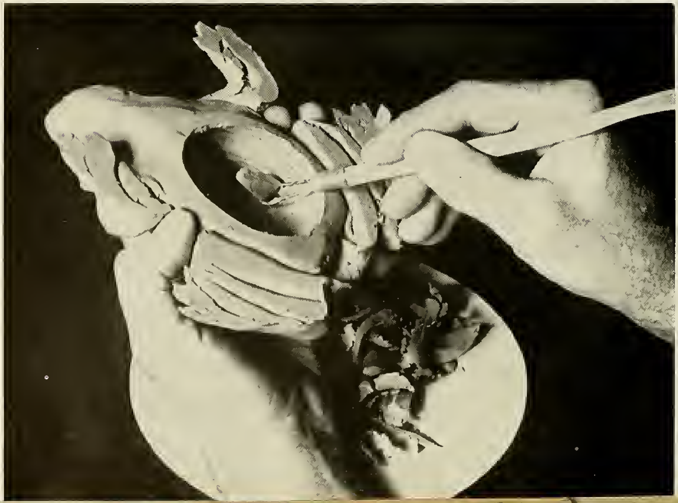
First Grade, Metcalf School
Normal, Illinois

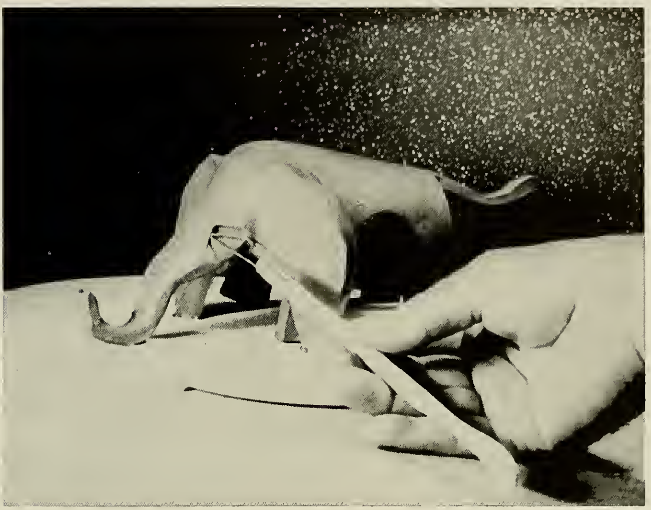
ROLL-OF-CLAY METHOD A simple and direct way of making an animal form, the roll-of-clay method, is a favorite of children. This manner of forming usually follows the push-pull concept. A large roll of clay is made for the body and four smaller ones for the legs. Sometimes the legs crack away or fall off in drying or in the first firing because they are merely stuck onto the clay body; they seem well attached at the time of making but have not been welded firmly to the basic structure. If the tops of the legs are scored and attached to the body with a little thick slip prepared from the same clay, this difficulty should not occur. A further insurance against separation would be the working of a small coil of clay around the top of the leg—into the angle between it and the body. Finishing touches may involve the use of tools, such as the cheese-cutter being used here to cut the mouth of the hippo.



HOLLOWING-OUT If any part of the clay sculpture is more than three-quarters of an inch thick, the inside should be hollowed. This is a simple matter in the case of most animal, head or bust sculptures because the piece can be inverted and hollowed from the bottom. Standing figures can be cut in two or more parts, hollowed and reattached with thick slip and pressure. Slip which squeezes out should not be wiped away immediately, but left to stiffen—at least until it is no longer shiny wet. The surplus clay thus formed can be used to work over the joint, which assures a better bond. Any piece which is cut open for hollowing, then reassembled, should have a tiny opening between the exterior and the cavity, so that there will be less danger of cracking or splitting in firing.

The method of hollowing-out is not as important as is the fact that it should be done. The small sculptures of younger children will usually survive the firing without hollowing, provided they are *thoroughly* dried before firing.



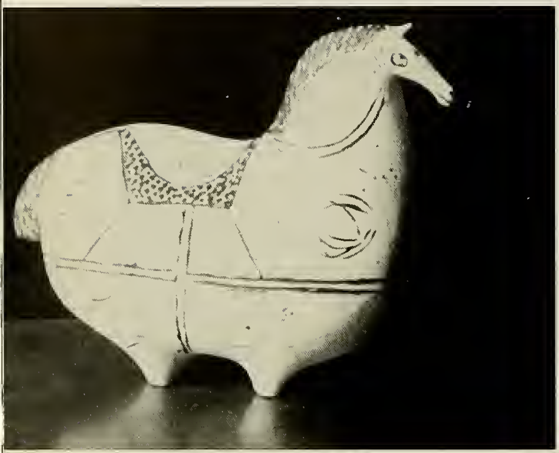


SLAB METHOD The slab method, appropriate as a means of shaping pottery forms, is also used for ceramic sculpture. It is a fairly sophisticated method, but if limited to very simple forms, can be employed at most grade levels. Not as direct as the push-pull or roll-of-clay methods, the slab method requires planning with understanding and imagination.

A single piece, embodying head, legs and body of any animal, is cut from a slab. When such a form is bent, after slight stiffening, the animal will stand. The project is started by drawing a double-profile pattern, similar to a Rorschach test, which is then cut out of the paper and bent along the back to test the idea. Animals are perhaps the best subjects for this approach because the four legs offer stability for the completed form.

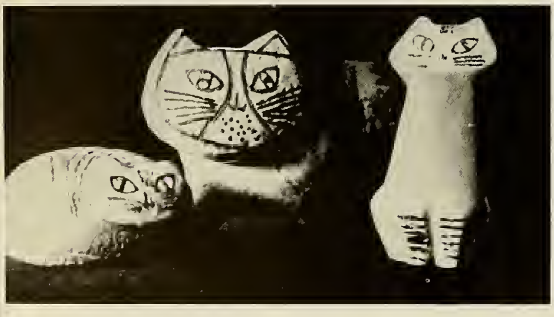
When an appropriate pattern has been determined, it is placed on a slab of clay rolled to about 3/8″ thickness and the clay cut. A rolling pin, bottle or thick dowel rod can be covered with some paper towels as a temporary support for the sculpture. The soft clay can be draped over the support, shaping the head at the same time. The head may need further propping, with a roll of clay.

Simple standing human figures may be made by a different slab method. A rectangular slab, for example, may be curved to form a slightly tapering cone which will serve as the body of a cloaked figure. A small spherical pinch pot could be inverted and attached, forming a head, or the head could be merely a piece of a slab, with some facial indications but retaining the slab quality. Coils or strips of clay can be fashioned and attached as arms. This is a simple but effective way of making standing figures, as for a Nativity or other grouping.



Compact and sturdy shapes are more suitable for ceramic sculpture than thin, delicate ones. Stig Lindberg, a Swedish designer, has simplified his horse's form, shortening the legs until they are almost non-existent, yet this is definitely a *horse.* The cats, by another Swedish designer, Lisa Larson, have also been highly simplified in form but the cat quality has not been sacrificed. Simplifying the form but emphasizing those features which give the individual animal its character is an important aspect of successful sculpture.

Projecting forms, such as tails, can often be curled around the body rather than extended. The composition will often benefit from so doing, as will the physical strength of the work, appendages being easily broken. Squirrels, seals, fish, buffalo and other bulky creatures are good subjects for animal sculpture. There is also the charm of the less graceful ones—the hippo, rhino, wart hog and pig. Whether animal or human shapes are attempted, the form should be simple and characteristic of the subject, with a minimum of extraneous detail. Eskimo sculptures provide good examples of the retention of the essence of the figure or animal, with utmost simplicity of form.



GLAZES AND GLAZING

Metcalf School, Normal, Illinois

A piece of pottery is not usually complete until it has been glazed. A glaze is a very simple thing: a thin sheet of glassy material which covers and adheres to an object made of clay. What is in a glaze? Materials taken from the surface of the earth. Borax, clay and sand, for example, ground to a fine powder, mixed with water, applied to the clay and subjected to intense heat will make a glass—another name for a glaze. Stated more simply: when a glaze is mixed and applied to a clay object, it must be fired in a kiln until the glaze materials melt and form a glassy coating.

Glazes can be mixed from raw materials in the studio or they can be purchased, either in dry or ready-to-use form. While it is both cheaper and of higher educational value for students to prepare glazes themselves, factors of space, length of class period, age of students and the number of students per class or in total, may eliminate the possibility. If this is the case, supply companies offer glazes of many types, some of which will be commented upon in this section. Inexpensive sample collections of commercial glazes are a good investment prior to the purchase of any sizable supply. Upon test-firing, these will give indications of the various types and colors available.

All factors permitting, a supply of a few raw materials will make possible student preparation of glazes. Just as a kitchen may be very elaborate, with every gadget, or very simple, with virtually none, so may the "glaze laboratory" be. The equipment may be limited to an eight-ounce cup, a set of measuring spoons, some pint jars with tight lids, a ruler, a screen and, perhaps, a glass or porcelain mortar and pestle. For greater accuracy in measuring materials, a scale of the type used in science classes (Harvard Trip) is useful although not necessary for the glazes included here.

Redford High School, Detroit

High school students should be encouraged to weigh out their own glazes. These may be, at first, according to batches of proven glazes. Later, variations and combinations may be planned, tested and evaluated. Some students, intrigued by the hundreds of possible combinations of materials and colorants, will find glaze experimentation by far the most fascinating part of ceramic study.

COMMERCIAL GLAZES A listing follows of some of the many types of glazes offered by ceramic suppliers. It serves, also, as an abbreviated "dictionary" of glaze types:

1. Clear Transparent Glaze. A most useful glaze for simple classroom projects in which decoration with colored slips or underglaze is included.
2. Colored Transparent Glazes. These, also, can be used over colored slips and are especially effective over carved or pressed treatments on clays firing white or light buff.
3. Semi-mat Glazes. These glazes are usually opaque and have a satin texture if fired to their prescribed temperatures. Depending upon the degree of opacity, engobe decorations may or may not be visible through these glazes.
4. Mat Glazes. These glazes are even more opaque and drier of surface than the semi-mats. This does not mean that the surfaces are unpleasant to the touch; they are simply less shiny than other glazes. They obscure all but the strongest decorating colors used under them.
5. Crackle Glazes. Usually considered a defect in a glaze, a crackle (network of small cracks) is sometimes used as a decoration in itself. The pattern can be made more prominent by rubbing black underglaze or India ink over the surface, then wiping away the excess.
6. Majolica Glazes. These are opaque glossy glazes, designed to flow freely during the firing. They are offered in many colors and should not be confused with the white (or light-firing) shiny glaze that is often referred to as "majolica base glaze," and is intended for use when majolica decoration is desired. The white glaze of the commercial majolica series, however, could be used in this manner if not overly-fluid in the fire.
7. Alligator Glazes. These glazes have a variegated texture which alternates between mat and glossy. They often create, by themselves, patterns of alternating colors.
8. Single Fire Glazes. Designed to be applied to greenware, these glazes should be used on clay that becomes vitreous at the same temperature as the glaze.
9. High Fire Glazes. Considering the temperature range covered by commercial glazes, these are higher-firing, maturing between Cones 4 and 6. They are intended for use on bodies maturing at these temperatures and are available in a variety of mat and glossy, opaque and transparent types.
10. Self-glazing Engobes. Half-way between a glaze and an engobe, these mixtures of colored slips and fluxes produce a non-glossy, non-running finish on pottery. Some mature at Cone 07 and are useful for sgraffito and slip painting, without a covering glaze.

GLAZE INGREDIENTS A glaze contains three main ingredients, each with its particular function. Silica is the glass-making ingredient. It is found in nature in the form of sand. It comes to the potter for glaze making in the form called "flint," a fine white powder. Silica, or flint, has an extremely high melting point; in order to form a glaze or glass at a lower temperature, materials called "fluxes" must be added.

The fluxes, second of the glaze ingredients, are of many different kinds, each of which produces a glaze of a characteristic type. Therefore, glazes are usually classified by the type of flux used. Lead glazes, for example, are those which use white lead or red lead as fluxes. Alkaline glazes may contain borax, soda ash or potash as fluxes. Feldspathic glazes are higher-fire glazes, using feldspars as fluxes.

In addition to the raw fluxes for forming glazes, prepared glaze ingredients named "frits" are available from ceramic supply houses. A frit is composed of glaze ingredients which have been melted together into a glass and, when solidified upon cooling, are ground into a fine powder. Frits cost very little more than the raw fluxes and have many advantages. First, when mixed with water, they make smoother and more easily applied glazes than do many of the raw fluxes, such as white lead and borax. Second, frits containing lead are safer to use than raw lead glazes, as the latter are likely to be toxic and should not be allowed to enter the body. Raw lead glazes *are* safe to use, however, with reasonable care. Hands should be washed after contact and spraying with them should be done in a well-ventilated place. The use of a lead frit eliminates these precautions. Third, alkaline frits have the advantage of being insoluble in water, whereas raw borax and soda ash are not and glazes containing these raw ingredients should be used shortly after they are mixed. Excessive water can not be poured or decanted from glazes containing raw alkalies without loss of part of the fluxing material.

The third main ingredient of a glaze is clay, which contains alumina and silica. The alumina controls the glaze's viscosity and keeps it from running off the clay object during firing. Window glass, which flows rapidly into a "pancake" or sheet when in a molten state, contains little or no alumina. Thus, in comparison with glazes, it is said to have low viscosity. Clay reaches the potter, today, in the form of fine powders. China clay or kaolin, ball clay, stoneware and fire clay are some of those available. Any of these could be used to supply the alumina, the third glaze necessity. Most glaze batches, however, call for kaolin or china clay, which are basically the same material—a white-burning, refractory clay.

Flint, flux and clay, the three main glaze ingredients, are frequently augmented by other minerals. Feldspar is a mineral containing sodium, potassium or lithium in addition to alumina and silica. It is a high-temperature flux but is also used in smaller amounts in low-temperature glazes because it furnishes so many of the oxides required. Whiting, from marble, limestone or chalk, known also as calcium carbonate, is a useful flux for high-temperature glazes. It can also be used in smaller amounts to give hardness to low-fire glazes. Wood ashes, well-washed, screened and dried, can be used as fluxes (with feldspar) to make some interesting glazes.

Zinc oxide and barium carbonate are useful in creating mat glazes. Opaque glazes may be achieved by the addition of up to 10% tin oxide or up to 20% of one of the commercial opacifiers, which are based on zirconium and sold as "opax," "superpax," "zircopax," etc. A mineral named rutile, impure titanium oxide, will provide some unusual effects in low-fire glazes, causing variations of both color and texture in the glazes. It is particularly effective when used alone or with copper or cobalt oxides. Granular ilmenite will give a speckled appearance in a fired glaze. Rutile can also be purchased in granular form and will give a similar effect.

GLAZE BATCHES FOR CLASSROOM PREPARATION Half the fun of working with clay lies in preparing glazes from raw materials. Making a glaze need not be a complicated procedure and for those who like to experiment, the experience can be rewarding and instructive. The following batches are offered for the beginner. The glazes are intended for use at Cone 04, with the exception of No. 8, which is a C/015 glaze.

Glaze No. 1	White Lead . . .	1 cup	(by weight, 3 parts)
	Flint	½ cup	(by weight, 1 part)

This glaze has good brushing qualities and adheres well to the bisque, without powdering off during handling prior to firing. It results in a glossy, clear transparent glaze somewhat yellowish in color.

Glaze No. 2	Borax	1 cup	(by weight, 4 parts)
	China Clay . . .	¼ cup	(by weight, 1 part)

This glaze has fair brushing qualities and adheres well. It results in clear, shiny transparent glaze and is rather fluid in firing.

Glaze No. 3	White Lead . . .	1 cup	(by weight, 2 parts)
	Borax	2 cups	(by weight, 2 parts)
	Flint	¾ cup	(by weight, 1 part)

This glaze has excellent brushing qualities but needs the addition of gum solution to prevent powdering off during handling. It is a clear, shiny transparent glaze, rather fluid, the best of the raw-flux glazes given here.

Glaze No. 4	Ferro Frit No. 3304 .	1 cup	(by weight, 9 parts)
	China Clay . . .	¼ cup	(by weight, 1 part)

This glaze has fair to good brushing qualities but needs the addition of gum solution to adhere well before firing. It results in a clear, shiny transparent glaze, slightly yellowish in color, with no tendency to drip or run down in firing. It shows good results even in a thin coating.

Glaze No. 5	Ferro Frit No. 3191 .	1 cup	(by weight, 9 parts)
	China Clay . . .	⅓ cup	(by weight, 2 parts)

This glaze has only fair brushing qualities but adheres well without gum. It is a clear, shiny transparent glaze, rather fluid, with a marked tendency to craze in a uniform pattern, making it a suitable base for the development of a "crackle." A transparent turquoise will result if two tablespoons of copper carbonate are added to a pint of this glaze.

Glaze No. 6	Ferro Frit No. 3134	1 cup	(by weight, 3 parts)
	Flint	⅓ cup	(by weight, 1 part)
	Bentonite	2 teaspoons	(by weight, 1%)

This glaze has poor to fair brushing qualities and will tend to settle in the jar without the bentonite. It adheres well, without gum, and results in a milky white, satin-surfaced glaze, especially interesting over red clay pieces. A pleasing opaque blue-green is provided when two level tablespoons of copper carbonate are added.

Glaze No. 7	White Lead	1 cup	(by weight, 1 part)
	Borax	2 cups	(by weight, 1 part)
	Flint	1⅓ cups	(by weight, 1 part)

If possible, this glaze should be ground in a mortar, to make the borax pass through the screen more readily. Borax being soluble in water, the glaze should not be stored for long periods of time but used soon after mixing. This glaze contains the same ingredients as Glaze No. 3 but, since it contains a higher proportion of flint, is correspondingly less fluid.

Glaze No. 8	Ferro Frit No. 5301	1 cup	(by weight, 16 parts)
(Cone 015)	Borax	⅔ cup	(by weight, 4 parts)
	Bentonite	3 tablespoons	(by weight, 1 part)
	Copper Oxide	1 tablespoon	(by weight, 1 part)

This is a low-temperature glaze intended for firing at Cone 015 (1480°F.) but can be used at slightly higher temperatures. The copper oxide added to the basic formula creates a good transparent turquoise glaze, suitable for ceramic jewelry or carved decoration. Since it is such a low-fire glaze, the pieces to which it is applied should be bisqued up to the maturing temperature of the clay being used. It this it not done, the glaze will craze.

These transparent glaze bases may be modified in many ways. A list of suggested colorants follows. Glaze technology literature is extensive and, for those who wish to go beyond the elementary information included here, the list of references in the last section of this book should prove helpful.

GLAZE COLORING OXIDES The same metallic oxides used to color decorating slips provide the colorants for glazes, although the results are somewhat different and depend upon the type of flux present and the firing temperature. Some oxides are very versatile in the colors they will produce. Copper, for example, will give grass green in a lead glaze; turquoise in a borax glaze; Persian blue in a soda glaze; gunmetal, if used in large amounts; and various shades of red. The latter are produceed in what is called a "reducing fire," during which oxygen is denied to—or taken from—the firing chamber. All the other copper colors are achieved in an oxidizing atmosphere, the normal fire.

Chrome oxide will provide an apple or lime green when added in small amounts to alkaline glazes and, when added to a high-lead glaze and fired at a low temperature (Cone 015 to 012), will produce an orange-red. In other glazes, it normally produces a strong green.

Below is a list of colors and the percentages of the metallic oxides needed to achieve them if the glazes are being weighed. If spoon measurement is desired, the listing on page 70 can be followed.

White		Tin Oxide 2% to 10% or Opax 4% to 20%
Yellow		Iron Oxide 4% or Rutile 3% to 8%
Tan		Manganese Dioxide 6%
Green		Chromium Oxide 3%
	or in a lead glaze	Copper Oxide 5%
Turquoise	in borax and in many frit glazes	Copper Oxide 4%
Blue	in a soda ash glaze	Copper Oxide 2%
	in lead and feldspar glazes	Cobalt Oxide 2%
Red-brown		Iron Oxide 10% to 15%
Beige		Nickel Oxide 6% plus Tin or Opax
Red	in a high-lead content, low-fire glaze	Chromium Oxide 1.5%
	in Glaze No. 8, preceding page	Selenium Oxide 5%
Black		Cobalt Oxide 2% plus Manganese Dioxide 7%

The percentages listed are suggestions only; if the color is too pale, more oxide may be used; if too dark, less. Glazes of different colors, but of the same basic formula, may be mixed to produce intermediate hues. Underglaze colors may also be used as colorants in glazes.

GLAZE PREPARATION The following steps may be followed in making up the glazes listed previously.

1. A gummed label, listing the ingredients in the glaze, is affixed to a clean pint jar. This is the number one rule in glaze making, the only way to be certain later of the jar's contents.
2. A second pint jar is two-thirds filled with water. As the ingredients are measured, they are poured slowly into it.
3. The cup or spoon should be filled to overflowing without packing the material down: it should be used just as it comes from the bag or carton. A straight edge, such as a ruler, is used to strike off the surface, providing a *level* measurement.
4. When all the ingredients are in the jar, the lid is screwed on tightly and the jar shaken until the contents are mixed thoroughly.
5. The contents of the mixing jar are next screened and placed into the labeled jar. A stencil brush may be helpful in persuading the larger particles to pass through the screen.

GLAZE ADDITIVES Two problems concerning glazing and the handling of glazed ware are decreased by the use of glaze additives—sometimes called "binders." The first problem is that of the ingredients in a liquid glaze settling to the bottom of the jar. An addition of about 1% bentonite (two teaspoonsful to a pint of glaze) will help to keep the glaze in suspension. A solution of either gum arabic or gum tragacanth is also an aid in keeping glaze ingredients in suspension. The gums may be purchased in powdered form. A stock solution can be made by mixing two tablespoonsful of either with a pint of water in a jar, shaking, allowing the solution to stand for an hour, then shaking again. Gum solutions aid not only in glaze suspension but in a second problem as well, that of unfired glazed surfaces powdering off when handled. Two tablespoonsful of the solution for a pint of glaze may be sufficient to correct the difficulty.

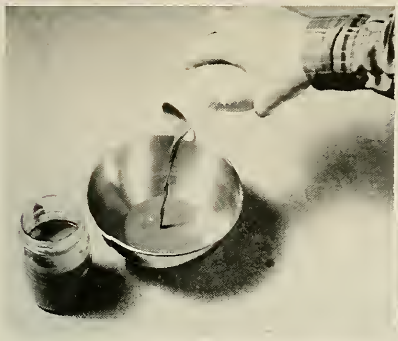
GLAZE CONSISTENCY The consistency of a glaze is one of the factors which determines the ease of application and, consequently, the fired result. Glaze should be *creamy* in consistency. It should not be watery, or it will run off the piece being glazed. It should not be too thick, or it will be difficult to apply it evenly. If a glaze is too watery, some of the water at the top of the jar can be poured off *unless* it is a glaze containing a raw alkali, such as borax or one of the oxides of soda. Such glazes should not be prepared with an excess of water, since pouring water off means a loss of some of the flux. If a glaze is too thick, water may be added in small amount until the desired consistency is reached. Glaze can be thicker for brushing than for pouring or dipping. For spraying, it should be thinner but not watery.

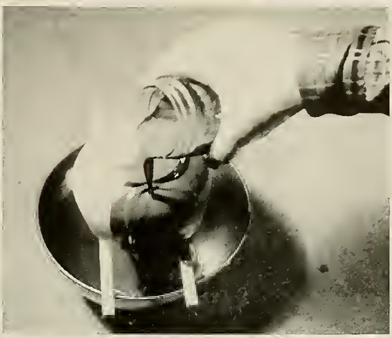
BRUSHING Applying a glaze by brush is the simplest method and requires the smallest amount of glaze. Care has to be taken, however, to insure an even coating. A soft, wide brush should be used to apply the glaze with even, slightly overlapping strokes in one direction, followed by a second coat at right angles to the first, then finished with a third coat in the original direction.

SPRAYING A common and professional method, glaze spraying requires more equipment than is commonly found in other than the most specialized classrooms. Although it is possible to utilize a large cardboard carton as a spray booth, equipping it with a simple turntable on which to revolve the ware, such an arrangement should be limited to those climates where the spraying can be done in the open air. Spray booths in the classrooms should be equipped with exhaust fans, to draw the glaze dust away from the operator. Such booths can be purchased or built-in. Some booths are now offered which do not require exhausting to the outside of the building, a decided advantage.

Required, also, is the gun itself and some means of providing air pressure for it. This may vary from a vacuum cleaner, with spray attachment, to a compressor of the diaphragm type to a large compressor with a tank. Ceramic materials are abrasive and the nozzles of guns which are not intended for glazes will wear quite rapidly, although they will serve for limited use. The advantages of glaze spraying are the even coating which can be achieved and the ease with which one glaze may be applied over another. The disadvantages are the equipment and space required and the maintenance of the equipment.

Peabody High School, Pittsburgh





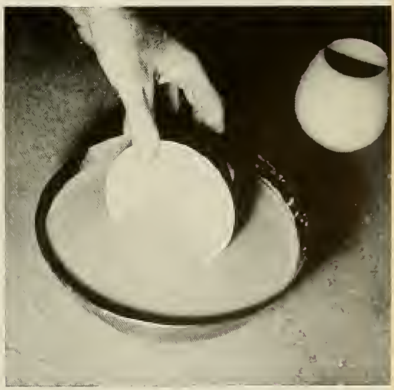
POURING The pouring method may be used on both the interior and exterior surfaces of a ceramic form. Glaze for pouring should be thin enough to pour readily. If it is too thick, the glaze coating on the absorbent bisque surface will become too heavy, even though the process is carried out with some speed.

The inside is glazed first, by filling the piece to about the half-way point, then emptying into a clean bowl immediately, rolling the form in at least one full revolution as it is inverted. At the end of the rotation, the excess glaze will pour out of the mouth or lip of the form, leaving an even coating within. The glaze will become very thick on the inside if the process is not done rather quickly, just as it will if the bisque is very soft and absorbent. If this is the case, a *very* quick rinsing of the interior with water before the glaze is poured in will help.

The form may be supported on two sticks placed parallel across the rim of a bowl while the outside is glazed. The glaze should be poured from a convenient container evenly down over the sides, the stream moving in a moderately slow motion around the form. If much pouring of glazes is to be done, the sticks can be replaced with a sheet of heavy screen, sold as hardware cloth, as a support. The advantage of pouring over brushing is that the glaze coating is more even. A disadvantage is that the rim edge must be touched up by brush after the piece has dried enough to be set upright.

DIPPING This is a quick method of glazing but requires not only more skill but a larger quantity of glaze than the other methods. The entire form must be passed through—or plunged into—a container of liquid glaze. Although an essentially simple method, dipping must be done with care. A proper relationship between the consistency of the glaze, the porosity of the ware and the speed of the dipping is necessary. Very porous bisque should be dipped more quickly and in thinner glaze than dense ware, since it takes on the glaze much more rapidly. How the form is held during the process and the size of the container of glaze required depend upon the shape of the piece.

Dipping and pouring may be combined on one form. First, pour the glaze into and out of the interior of the piece, then hold the form by the foot and plunge it straight down into a container of glaze. Air pressure will build up inside the inverted form if it is not allowed to tilt and no glaze will reach the interior unless the piece is tilted.



DRYING GLAZED WARE Glazed pieces should be allowed to dry before stacking or, at least, before starting the kiln. An infra-red heat lamp will prove useful in drying freshly-glazed pieces before attempting to apply the glaze. Bisqueware which is too dense will not absorb moisture from a glaze being applied to it; heating the form with a lamp, in a freshly-unstacked warm kiln or even on a stilt over a hot plate will help to counteract the lack of absorbency. The water in the glaze will be evaporated by the heated piece.

Glazed ware will suffer no ill effects if it is not fired soon after glazing. Years, in fact, could pass between the glazing and the firing without affecting the final glazed surface.

GLAZE DEFECTS AND CORRECTIONS Sometimes glazes "crawl"—that is, they leave bare spots on the fired ware. This is most often due to dust or grease on the surface of the bisque. Dust should be blown off, then wiped with a damp—not wet—sponge. Grease on bisque usually results from too much handling prior to glazing. Some students *will* hold their pieces, turning them around and around in their hands, while deciding upon a decorative treatment or the glaze to be used. Most people have some oil on their hands, which is readily transferred to a bisqued surface. Pieces with crawled glazes can be heated, the bare spots retouched with the original glaze, and refired. The second glaze firing will probably correct the flaw.

If a glazed piece has bubbles on or in the surface, four possible causes could be considered: (1) the glaze was underfired; (2) the glaze was overfired; (3) the particular glaze contains an ingredient that causes it to bubble violently during the firing; or (4) the glaze was applied too thickly. The latter applies particularly to transparent glazes, where minute bubbles can be seen *under* the surface—gases which are so weighted down by the thickness of the glaze that they can not escape. If underfiring has caused the bubbles, they will often disappear during a second or higher firing. Another indication of underfiring is a dry and sandy surface: the glaze should be fired to a higher temperature or its composition altered so it will be satisfactory at the desired lower temperature.

A streaked effect of thin and thick areas of glaze simply means that the glaze was not applied in an even coating. Again, the piece may be heated and more glaze applied before re-firing. Sometimes, however, the length of time spent in trying to apply more glaze to the moisture-proof surface might better be spent in making a new piece.

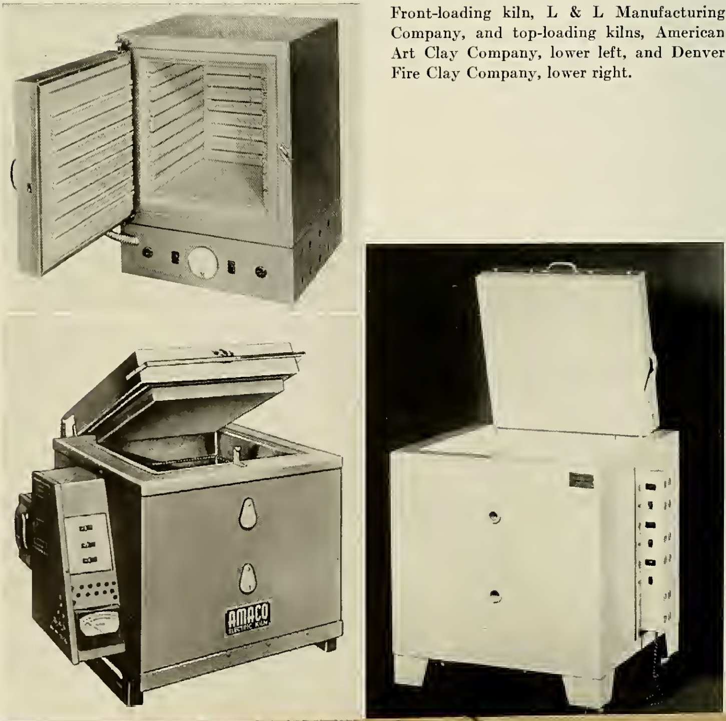
"Crazing," a network of fine cracks in a fired glaze surface, is often a result of underfiring the clay itself. Stoneware clay fired to a low temperature, for example, with a low-fire glaze, generally results in crazing—particularly if the glaze is a clear, transparent one. One way, then, to avoid this defect is to use a low-fire clay that fires dense at Cone 05 or 04. Another correction is to increase the flint content in the glaze batch. When possible, increase the glaze-firing temperature so that it corresponds with the maturing temperature of the clay body being used. If the clay becomes dense in the glaze fire, there will seldom be crazing. If there is, adjust the glaze with the addition of flint.

KILNS AND FIRING

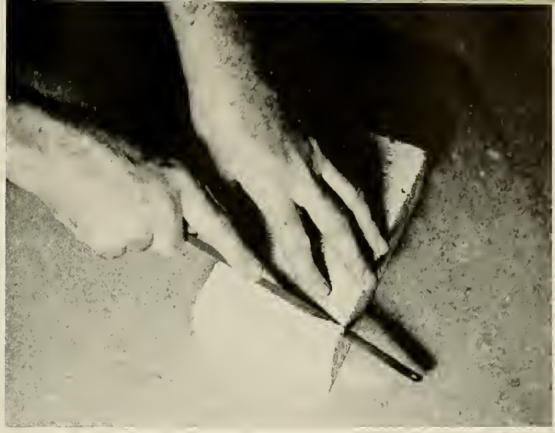
Herman School, Detroit, Michigan

KILNS Clay in the classroom will achieve its full significance only if student work can be fired. The excitement which inevitably attends the opening of a glaze kiln never diminishes; even potters with years of experience find this true. Although the purchase of a kiln represents the initial major expense for a classroom pottery area, firing facilities are essential if other than the most superficial understanding of the medium is to be realized.

Studio or school kilns are usually fired by either electricity or gas. The electric kilns are recommended for most school situations because they are more simply operated and the safety factor is greater. Kilns are available in either top- or side-loading models and with either low-fire or high-fire elements (2000°F. or 2300°F.). The top-loading models are cheaper than the side-loading models because they are less expensive to manufacture. A top-loader, with high-fire elements and a larger firing chamber will, therefore, cost approximately the same as a smaller side-loading kiln with low-fire elements. A side-loader, which has a hinged door in front and may be set on a table or counter, is more convenient to load, but if budget is a factor, the top-loader is a better buy. Kilns which "fire your clay in an hour" should be avoided; they are not engineered for clay, a material which requires time—as well as slow temperature rise—during firing.



Front-loading kiln, L & L Manufacturing Company, and top-loading kilns, American Art Clay Company, lower left, and Denver Fire Clay Company, lower right.



KILN FURNITURE Kilns require "furniture"—shelving and shelf supports. The kiln supplier can furnish these in sizes and weights suitable for the kiln. Some suppliers offer shelving in two materials, either fire clay or silicon carbide. The clay shelves are less expensive and, for the low-temperature firings in the classroom, should have a long life. Clay shelving, at higher temperatures and with constant use, can warp. Silicon carbide shelving will have longer life, with less warpage.

A good supply of shelf supports of various heights is needed for efficient stacking. Commercially-available supports are manufactured from high-temperature clays, so they will not deform under the weight of kiln shelves. Supports may also be made in the classroom by cutting sets of equally-sized pieces from soft, lightweight insulating brick, available at building supply companies. A saw-tooth block scraper or a hacksaw blade will cut them easily. Saws used for wood should not be used because the abrasive character of the brick will destroy the set within moments.

KILN WASH When the kiln has been installed and the furniture purchased, a coating of kiln wash on the bottom, *only*, of the firing chamber and on the top surfaces, *only*, of the shelves will protect them from drippings during glaze firings. If drips fall on unprotected surfaces, chipping away the fused glaze is difficult, but if the surfaces have been sufficiently coated with kiln wash, the fused drippings will chip away quite readily.

Kiln wash may be composed of one part flint and one part china clay: an addition of 2% bentonite will help to keep the mix from settling and offer some bond. Kiln wash may also be made from equal parts flint, china clay and ball clay, the latter acting as does bentonite. In either case, the dry materials are mixed with water until a creamy consistency is reached. Ready-to-use kiln wash is available from suppliers, although more expensive than that made in the classroom.

Surfaces may be coated with kiln wash more easily if they are quite warm. A new kiln can be heated for a few minutes, then turned off, before applying the kiln wash to the inside bottom with a wide, flat brush. The shelves could be set into the kiln to heat or be placed on hot radiators for a few hours. The shelves, particularly, having been high-fired during manufacture, have virtually no absorbency, so that achieving more than a too-thin initial coating of kiln wash is difficult. Heating them, therefore, is an aid in building up the kiln wash coating rapidly. The finished surfaces should be smooth—not composed of hills and valleys, which could cause tilting of stacked ware. Kiln-washed surfaces should dry before firing the kiln.

BISQUE FIRING The kiln is now ready for a bisque firing. The purpose of the initial firing is to harden the clay forms so that they may be handled more readily in glazing and to eliminate the dangers of glazing raw clay, which easily becomes saturated with water and could crack if not actually deform during the glazing process.

This firing may be carried out at a temperature lower than that required to mature the clay or clay body. For example, if a Cone 04 clay body is being used and will subsequently be covered with Cone 04 glaze, a Cone 09 firing will serve nicely for the bisque fire. At this temperature, the bisque will be somewhat absorbent, so that the application of glazes will be easier than it would be if the clay were fired up to 04 in the bisque. Cone 09 bisquing is both adequate and advantageous for all bodies maturing at Cone 04 or above. If the clay being used matures at less than Cone 04—Cone 06, for example—the bisquing temperature could be dropped a cone or two—to Cone 010 or 011.

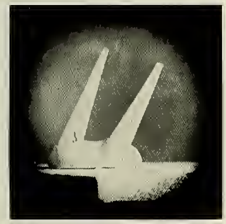
Pieces to be bisqued must be *thoroughly* dry. Sometimes a piece appearing to be dry on the outside will still be damp inside. An old—and quite reliable—test is to place the *bottom* of the form against the cheek. Any sensation of coolness indicates dampness.

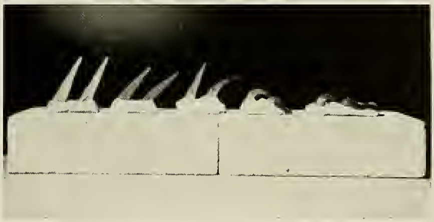
Stacking a bisque kiln is comparatively easy because it is not necessary to place the ware on supports, nor does it matter if the pieces touch each other. The work is set directly upon the bottom of the kiln and on the shelves, provided they are free of previous glaze-drippings. Placing one piece within another or atop another is permissible—and desirable—in bisquing. They will not stick together unless the bisquing temperature is too near the maturing temperature of the body or one piece is set into another which has been decorated with slip or underglaze that has enough fluxing material present to permit some fusion.

Common sense should prevail. For example, a heavy piece of ceramic sculpture should not be placed on a flat plate—even though that might seem the best momentary solution to the problem of space in the kiln. Bowls of similar size are better "boxed"—one upside down on the other, rim to rim—than stacked in a pile, one inside another. Pieces of the same size may shrink a bit differently, depending upon the thickness of the walls and whether or not they are of different clays. Small items, such as jewelry, sculptures, test tiles and the like, may be piled into open forms or directly on kiln shelves. They may be considerably jumbled although they should be placed carefully and not tightly packed.

The unstacking of a classroom kiln usually takes place in the morning of the day following the firing, assuming that the kiln "went down" during the previous afternoon or evening. Bisqued ware may be removed from the kiln even if it is too hot for bare hands. A pair of barbecue mittens or ordinary work gloves may be kept near the kiln for unstacking purposes.

If any pieces appear to have slumped during the bisque firing, a lower bisquing temperature is indicated for the next time. Of the several mishaps which can occur during bisquing, the deformation of clay should not be one of them. Failures in bisquing may usually be traced either to overly-fast firing, particularly in the early stages, or to careless stacking. When bisque firing in any kiln, it is advisable to raise the temperature slowly. Some electric kilns have only a single switch, so every element carries electricity throughout the firing. Others have two or more switches, or a single switch with three positions. Raising the temperature slowly may necessitate, in the case of a kiln with a single on-off switch, turning the kiln on for perhaps 10 minutes, off for 20, on for 10, off for 20, then on continuously until the desired temperature is reached. It may, furthermore, sometimes be advantageous to leave the door of the kiln slightly ajar for the first half-hour of firing to avoid any concentration of a steam within the chamber. This is not usually necessary, except with a new, very tightly-constructed electric kiln. As soon as the kiln has been fired a few times, it will not be *that* airtight.

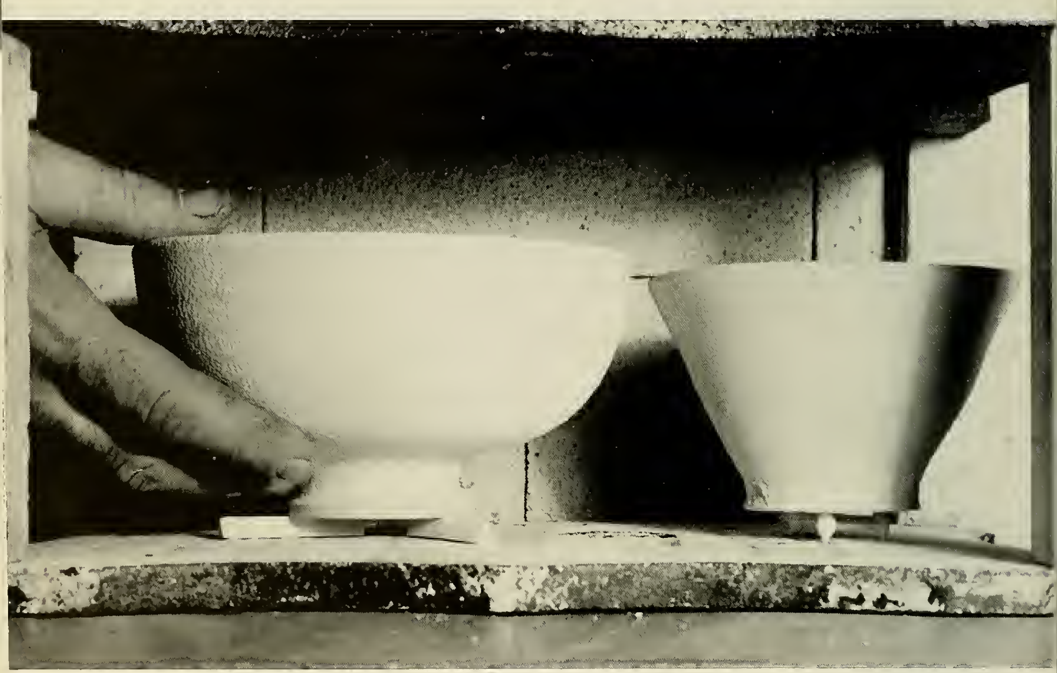




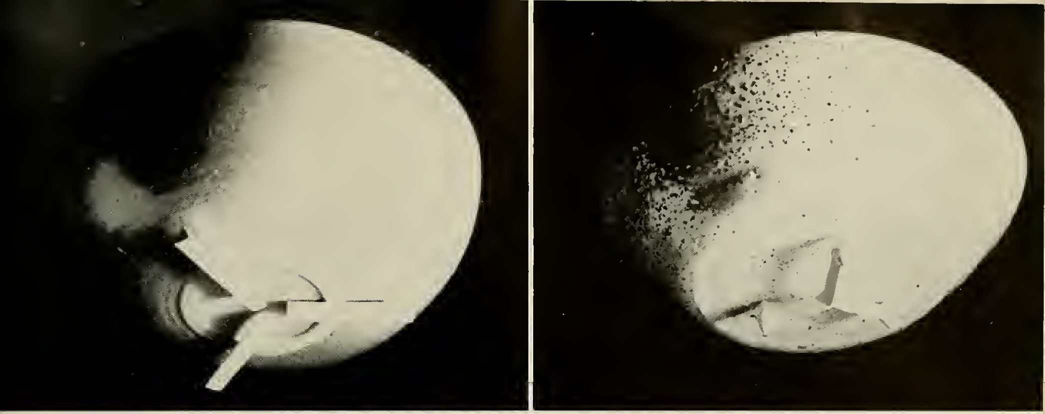
PYROMETRIC CONES Pyrometric cones are used in kiln firing to indicate when the desired temperature has been reached. They are carefully compounded of clay and fluxes by the manufacturer so that they will bend over at specific temperatures. At the left is a view of cones in position behind the peephole of a kiln. The cone to the left of the pair is labeled "04" and the one at the right "05". The 05 cone will bend before the 04 cone. It will serve as a warning for closer checking of the kiln's progress. When it bends, the other will soon follow. The cones are therefore set into a clay pat so that the cone bending at the lower temperature will not fall onto the second, but away from it, as may be seen in the series of pats at the right. The pats should be made up in advance of firing: to place a moist cone pat in a kiln is to invite disaster because it will blow up in the early stages of the firing and the cones will be lost to sight. When the tip of the cone representing the temperature desired bends enough to be about in line with the base of the cone pat, the firing is complete.

Some kilns, including two of the three illustrated in this section, are equipped with pyrometers, from which temperatures may be read directly. It is advisable to check the pyrometer on a new kiln by placing cones within the kiln, to ascertain whether the pyrometer is providing an accurate reading. If it is, then the pyrometer alone may be relied upon.

GLAZE FIRING Although the stacking of a glaze kiln is a bit more involved than is the bisque, the opening is much more exciting. A supply of stilts, variously sized, triangles and thin slabs of insulating bricks should be easily at hand near the kiln. Star stilts, tiny stilts with nichrome wire points, are useful for stacking ceramic jewelry.



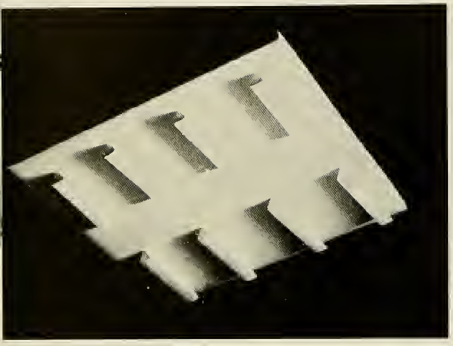
This simulated kiln interior permits a view of the floor of the kiln, shelf supports and a shelf and illustrates the placing of glazed ware for firing. A clearance of one-half inch between pieces is desirable. Sometimes, when stacking a front-loader, it is difficult to *see* the amount of space between the pieces but if a finger can be passed around each piece or between pieces, the stacking will be satisfactory. Actually, the space could be less than the thickness of a finger, since each piece will shrink further, but a larger dimension could mean less kiln loss through tipping or dripping.



If a kiln shelf were transparent, as is the piece of glass used here to represent it, and if it could be viewed from underneath, glazed ware placed in the kiln would appear as illustrated. The bowl at the left has been scraped and sponged free of glaze on the bottom; it is "dry footed." It may, therefore, be set upon three triangles to raise it from the kiln shelf. Without the triangles, the bowl could fuse to the shelf if any glaze ran down around the foot. With the triangles, running glaze may fuse to them and, in extreme cases, the foot may be damaged when the supports are broken away. Dry footed ware may also be fired on thin slabs of insulating brick, a method which has some advantages: less vertical space required; less juggling in stacking; more even support, with less warpage; further protection for the kiln shelf in the event of running glaze; easier removal if fused to the ware; and easier grinding away of particles of fused glaze.

The bowl on the right has been covered completely with glaze. It is, therefore, fired on a stilt, the points of which are fairly sharp and will leave only tiny marks in the fired glaze. Depending upon the thickness of the glaze application, these marks may be surrounded by very sharp edges after the stilt is removed, so that grinding either by hand or mechanical means is required. Thinner application of glaze on the bottom of the form should alleviate this difficulty. Another disadvantage of stilts is the fact that as the clay piece shrinks on a stilt, it may move unevenly, losing its balance and tipping to one side, touching and sticking to other objects in the kiln. The advantages of the stilt are: the bottom of the ware is smooth and won't scratch table surfaces as easily; and delayed crazing of the glaze is less likely.

Considering the three possible means of supporting glazed ware in a kiln, the use of thin slabs of insulating brick under dry-footed pieces seems to offer the most advantages for beginners' work. Its greatest disadvantage: If the clay body is not mature, glazed forms with unglazed bottoms may craze eventually, due to the absorption of water by the porous body.



The glass "kiln shelf" again offers a view from below. Flat pieces, such as hand-made tiles larger than 4″ x 4″ will be less likely to warp if they are openly and adequately supported by a number of triangles, thus permitting some heat circulation in both bisque and glaze firings. If, however, the body is one which might slump—sag between supports—in the glaze fire, a *level* grouping of thin slabs of insulating bricks could be used. When there is little danger of glaze running—as on the sides of a tile—it may be fired on the shelf. A sprinkling of aluminum hydrate, flint or fine sand on the shelf will facilitate the movement of the tile as it shrinks during the firing.

Raising the temperature of the glaze kiln may proceed more rapidly than may be done safely with bisque. The glazed pieces should be dry, not saturated with water from the glazing process. When damp, freshly glazed ware is fired immediately, steam builds up within the clay walls of the ware. As it tries to escape, it *can* push the glaze coating away from the surface, causing it to fall off in flakes before the firing process has really begun. The degree to which this difficulty arises depends upon the method of glaze application and how wet the form is. Pre-drying is wise.

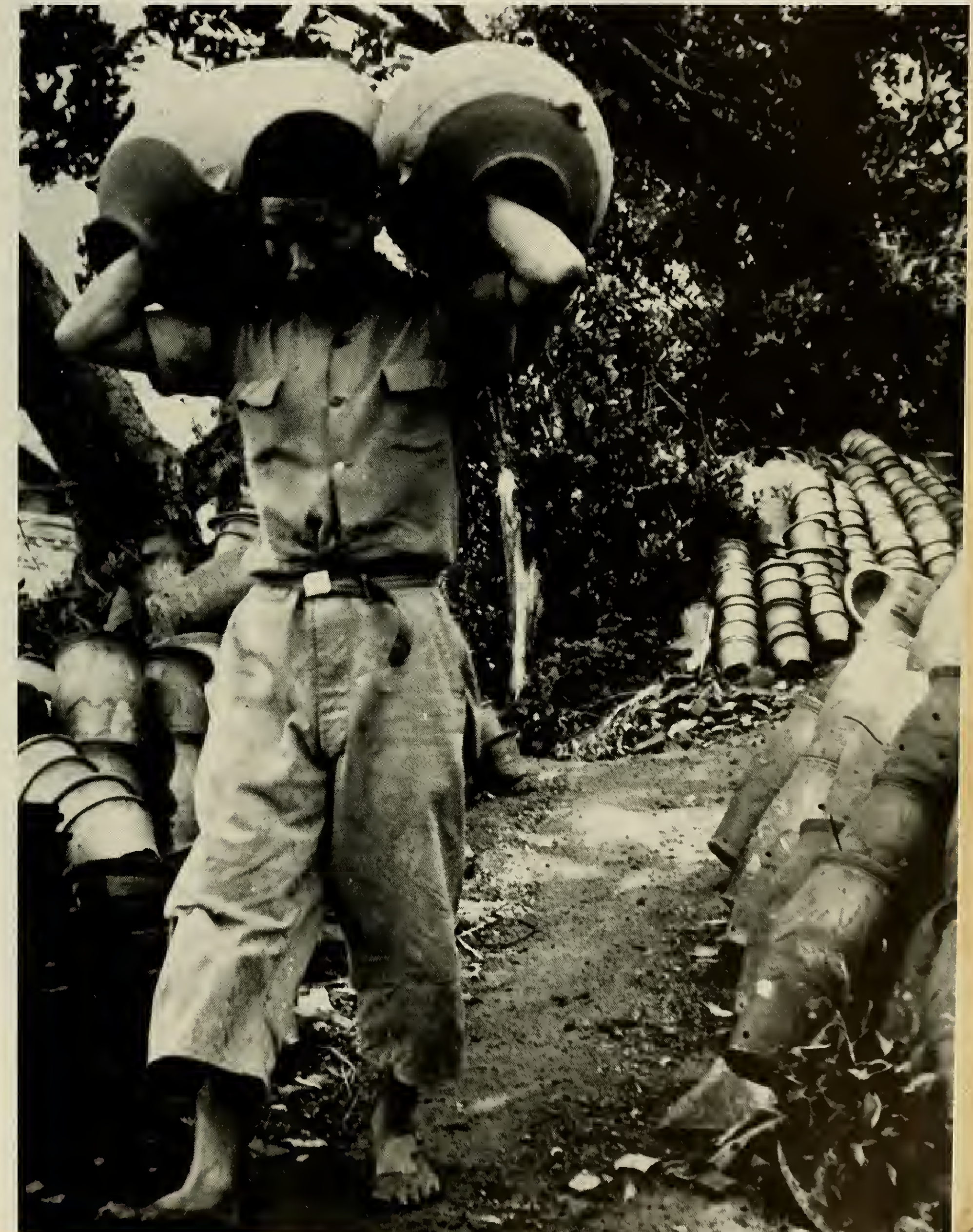
The temptation is to open the door of a cooling glaze kiln, to peek in to see how the glazes turned out. If the temperature is below 500°F., a brief glance will do no harm. The door may then be left slightly ajar and within a fairly short time the pieces can be removed without danger of too-fast cooling for them or singed arms for the students.

Although two firings—the bisque and the glaze—are desirable for all clay work, it *is* possible to eliminate the bisque fire in the case of thin, light-weight forms such as ceramic jewelry. Some students will want to take this shortcut, regardless of the size, weight or type of form being fired but the explosion of a single-fired piece, in a kiln filled with glazed pieces, means disappointment for many—not for the over-eager one alone. Another disadvantage of once-firing is that some glazes—especially those containing raw soda or borax—react differently on raw clay than they do on bisque. When applied to raw clay, the glass-forming materials in the glaze, being soluble in water, are absorbed by the clay particles, so that the glaze will not have the degree of glassiness it should; it may result in a very dry surface. When the same glaze is applied to bisque, the water in the glaze is absorbed by the form but evaporates back onto the surface more easily.

Electric kilns, manufactured by established, reliable firms, are eminently safe for the classroom. The manufacturer or the retail supplier furnishes firing instructions, which are not complex, so that no classroom teacher need be hesitant about securing and operating—or permitting supervised students to operate—a kiln.

REFERENCE MATERIALS

Courtesy Raymond Boyko



BOOKS, MAGAZINE AND FILMS References and visual aids can add to any course of study. Books and magazines play a much greater role if they can be within the pottery area of a classroom or in the art room, rather than in the school library. This point of view, unfortunately, is not usually that of the librarian or book committee. If the teacher wants a small library in her room, she frequently contributes her own books and magazines. They may become smudged and dog-eared but to what better purpose than their immediate availability to an eager student?

The listing which follows is annotated, to provide some assistance in choosing reference materials and films. The books included are not the most advanced and technical but those which could be of interest to those who have had introductions to pottery and would like to pursue the subject further.

BOOKS

Binns, Charles—The Potter's Craft. Van Nostrand Company, New York, 1947. A good text, especially on mold-making and glaze theory and practice.

Cox, George J.—Pottery for Artists, Craftsmen and Teachers. MacMillan, New York, 1914. Sound craftsmanship is never outdated. Still a good book, covering all phases of the ceramic field. Clearly illustrated by the author.

D'Amico and Hamlin—How to Make Pottery and Ceramic Sculpture. Museum of Modern Art, New York, 1947. A clearly written series of simple ceramic projects. Good illustrations.

De Sager, Walter—Making Pottery. Studio Publications, New York, 1947. Not complete but some good illustrations and directions, especially on wheel work, glazing and slip decoration. Written in simple terms.

Dougherty, John—Pottery Made Easy. The Bruce Publishing Co., Milwaukee, 1949. A wide variety of ceramic activities, briefly presented. Directions for an outdoor kiln and a home-built wheel.

Honey, W. B.—The Art of the Potter. McGraw-Hill Book Company, New York, 1944. Excellent, carefully documented pictorial examples of historic pottery, from the Bronze Age, Cyprus, to contemporary England and Europe.

Kenny, John B.—The Complete Book of Pottery Making. Greenberg, New York, 1949. As the name implies, a comprehensive and well-illustrated book. Good information on low-temperature glazes.

Kenny, John B.—Ceramic Sculpture. Greenberg, New York, 1953. A well-illustrated book on ceramic sculpture processes, including glazes for ceramic sculpture.

Leach, Bernard—The Potter's Book. Faber and Faber, Ltd., London, 1940. An extremely readable book on the potter's art, with special reference to pottery-making in Japan and England.

Long, Lois—Ceramic Decoration. The American Art Clay Co., Indianapolis 24, 1958. An inexpensive but comprehensive manual on decorative processes for pottery. Well illustrated.

Nelson, Glenn C.—Ceramic Reference Manual. Burgess Publishing Co., Minneapolis, 1957. General, basic information, written in easily understood terms.

Norton, F. H.—Ceramics for the Artist Potter. Addison-Wesley Press, Inc., Cambridge, Mass., 1956. Comprehensive coverage of glazes and glaze-making. Written by a ceramic engineer and highly technical in some—but not all—aspects.

Poor, Henry V.—A Book of Pottery. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1958. Subtitled "From Mud into Immortality," this is a highly personal testimonial to the potter's love for his craft. Fine illustrations, some in color.

Randall, Ruth—Ceramic Sculpture. Watson Guptill Publications, New York, 1948. A well-illustrated book of simple sculpture methods.

Rhodes, Daniel—Clay and Glazes for the Potter. Greenberg, New York, 1957. Basic information on clays and glazes but a reference for advanced, older students only.

Stiles, Helen—Pottery of the Ancients and Pottery of the American Indian. E. P. Dutton, New York. These books were written for children but are interesting to all ages. They show the part ceramics has played in the life of man. Well illustrated.

Torbert, Meg (Ed.)—Design Quarterly, Double Issue, Numbers 42 and 43. Walker Art Center, Minneapolis, 1958. A splendid pictorial review of the work of 82 leading contemporary potters. Inexpensive, unique reference.

MAGAZINES

The number of magazines directed to, or of interest to, potters is not large. Only the first of the following is published expressly for the studio potter, as contrasted with several which are published for those who pursue ceramics purely as a hobby. Magazines of the second type are not included here because the standards they set forth are not those to which young students or serious students of any ages should be introduced, exclusively.

Ceramics Monthly—Professional Publications, Inc., 4175 North High Street, Columbus 14, Ohio. Monthly except July and August. One year, $5.00. Many good articles on form, technique, decoration, glazes and enameling.

Craft Horizons—Craft Horizons, Inc., 29 West 53rd Street, New York 19, New York. Published bi-monthly at $4.00 a year. Excellent articles on contemporary crafts and often on ceramics. All on a high level, with fine illustrations. This is an inspirational, rather than a technical or how-to-do-it reference.

Creative Crafts—Oxford Press, Los Angeles 38, California. Published bi-monthly at $5.00 a year. Offers articles, well-illustrated, on various crafts, including ceramics. Similar to *Craft Horizons,* in that it does not explain how to produce craft items but, rather, gives news of what has been and is being done.

FILMS

The list of films which follows is included here through the courtesy of *Ceramics Monthly* Magazine. They are 16 mm., black-and-white, sound films, unless otherwise specified.

Audio-Visual Center, Indiana University, Bloomington, Indiana: all films are 10 minutes; in color; $3.00 for five days; $100.00 purchase.

Decoration—This and the following five films make up the "Craftsmanship in Clay" series released by Indiana University. Each is under the direction of Karl Martz, Director of Ceramic Arts at Indiana, and he himself gives the demonstrations.

In "Decoration" is demonstrated the use of three basic materials for applying decoration on a clay surface—clay, glaze, and slip. Mr. Martz also explains the mishima, sgraffito and wax-resist methods. Summary includes representative pieces done by using the three materials.

Glaze Application—Presents four methods—dipping, pouring, brushing and spraying—and points out the advantages of each. Demonstrations include special techniques, proper preparation of a piece of clay for glazing and precise finishing before firing, with stress on good craftsmanship.

Simple Molds—The latest release in the series. Mr. Martz demonstrates how a piece is made from a mold by the slip casting, draping and pressing methods.

Simple Slab Methods—Mr. Martz takes the viewer through the steps of forming a candleholder directly from a lump of clay, rolling a slab for a simple tile and constructing a flower container from several pieces of clay. Correct use of basic tools is emphasized.

Stacking and Firing—Shows the correct stacking of both green and glazed pottery in a small kiln and each step of the firing process. Spectator is shown the use of stilts and plate pins to support the pieces, placement of the ware in the kiln, the use of pyrometric cones and the necessity for firing and cooling pieces carefully.

Throwing—Illustrates the forming of pieces on the wheel, removing from the wheel, trimming the base, forming a foot rim and using special throwing techniques in shaping a plate and pitcher.

Av-ed, 7934 Santa Monica Boulevard, Hollywood 46, California: all films are 10 minutes; rental, $3.00 a day, $6.00 a week; purchase $50.00 black-and-white; or rental, $6.00 a day, $12.00 a week and purchase $100.00 for color.

The Potter's Wheel—Richard Petterson demonstrates how to throw pitchers. A review of examples of thrown ware is given.

Simple Ceramics—Mr. Petterson shows how to use simple household utensils for decorating a clay slab which is later slung in a hammock mold to make a ceramic form.

Making A Mosaic—The making of a mosaic from the original sketch to completion is demonstrated by Ada Korsakaite. Also she shows the making of handmade ceramic tile, rolled and cut from common clay. Another sequence pictures a 10-year-old making a checkerboard from uniform squares of commercial tesserae.

Ceramic Glazes—The mixing of an opaque mat and a stone glaze, both showing wide firing latitude and high color receptivity, are demonstrated by Richard Petterson. Glaze application by various methods plus kiln interiors during firing are shown.

Press Mold Ceramics—Using simple tools, Ada Korsakaite carves a group of figures in plaster and then presses clay into the carving to form a plaque. Demonstrating the simplicity of the method, a 10-year-old carves and presses several medallions.

Brandon Films, Inc., 200 West 57th Street, New York 19, New York: the film rental is $3.00 a day, $50.00 purchase and runs for 10 minutes.

Clay Pottery—The process of creating pottery, from the digging of the clay to the finished product, is shown. Produced in cooperation with the Universal School of Handicrafts, New York.

Contemporary Films, Inc., 267 West 25th Street, New York 1, New York: the film runs 20 minutes; color; rental $10.00 first day, $5.00 following; $185.00 purchase.

Chinese Ceramics Through the Ages—The world has known only too well the origin of porcelain, commonly called "china." Yet the full range of the accomplishments of the Chinese potter and the meaning of the interdependence of various cultures for their nourishment and growth, can only be understood by viewing the evolution of Chinese ceramics from Neolithic earthenware down to pure porcelain. This film is designed to offer such a panoramic view.

Encyclopaedia Britannica Films, Inc., 1150 Wilmette Avenue, Wilmette, Illinois: the film runs 11 minutes; rental $2.50 for one to three days; purchase $50.00.

POTTERY MAKING—The film describes each step in the making of pottery by four different methods. A vase is formed on a potter's wheel, an Indian bowl is fashioned with coils of clay, a vase is made in a plaster mold and a table piece is assembled from patterned slab pieces. Explains how each object is dried, bisqued, glazed and glaze-fired.

Paul Hoefler Productions, 1122 Kline Street, La Jolla, California: the film cannot be rented; 11 minutes; color; $110.00 purchase, including reel, can shipping.

MEXICAN POTTERS—Pottery making is depicted as part of the art of living in Mexico. The audience learns how the native Indian, the Spanish-Colonial and the Modern International cultures influence the Mexican arts and crafts.

International Film Bureau, Inc., 332 South Michigan Boulevard, Chicago 4, Illinois:

ABC OF POTTERY MAKING—A demonstration of the coil method of pottery making. This film shows the use of template pattern, hand tools and the potter's wheel. Adapted to beginning students in high school and adult art classes. 9 minutes; rental $3.00; $50.00 purchase.

ARTS AND CRAFTS OF MEXICO—Native craftsmen are shown in their home workshops. Basket weaving, glass blowing and the techniques for making pottery are treated. The film concludes with a display of Guadalajara pottery and a discussion of its unique characteristics. 11 minutes; $2.50 rental.

CRAFTS OF FIRE—This film depicts the part fire plays in the making of enamels, glassware, porcelain, pottery and dinnerware. 10 minutes; rental $3.00.

THE POTTER—A University of Southern California production featuring Otto Heino. This film is useful for art and craft groups on the secondary, college and adult levels. 13 minutes; in color; rental $6.00; $100.00 purchase.

PUEBLO ARTS—In this film are many fine "shots" of Maria of San Ildefonso, the well-known Indian potter. 10 minutes; in color; rental $4.50; $120.00 purchase.

STORY OF PETER AND THE POTTER—The story of a young boy meeting a family of clay craftsmen and watching them carry out the various stages of molding, shaping, painting, firing and glazing a bowl. 21 minutes; in color; rental $7.50; $190.00 purchase.

McGraw-Hill Book Co., Inc., Text-Film Dept., 330 West 42nd Street, New York 36, New York: the films are for use in elementary schools. 11 minutes; rental; $60.00 purchase.

LET'S PLAY WITH CLAY: ANIMALS—Only the hands are used to make such simple forms as a bird, pig, rabbit, fish, cat and snowman.

LET'S PLAY WITH CLAY: BOWLS—The film begins with rolling a piece of clay between the hands to make a ball, then shows how to form this into a variety of useful shapes—a teacup, saucer, cream pitcher, sugar bowl and several decorative bowls.

CERAMIC SUPPLIES The problem of searching out firms from which to purchase ceramic equipment and supplies for schools has been greatly decreased as the number of supply houses has increased. In addition to those listed below, which do business in general ceramic needs on a nationwide basis, scarcely a large town or city is without a ceramic supply company. The national firms usually offer a wider range of materials and equipment but the immediate availability of materials from a regional supplier is sometimes an important factor.

American Art Clay Company
4717 West 16th Street
Indianapolis 24, Indiana

B. F. Drakenfeld and Co., Inc.
45 Park Place
New York 7, New York

O. Hommel Company
Pittsburgh 30, Pennsylvania
(West Coast: 4747 East 49th Street
Los Angeles, California

Stewart Clay Company, Inc.
133 Mulberry Street
New York 13, New York

Many local suppliers serve as distributors for kilns and are always willing to discuss the requirements of a particular classroom with the teacher. Being able to view several models and to discuss the problem is helpful when a kiln is to be purchased. In addition, literature may be obtained from the following kiln manufacturers:

A. D. Alpine, Inc.
11837 Teale Street
Culver City, California

American Art Clay Company
4717 West 16th Street
Indianapolis 24, Indiana

C. M. Buell Kilns
Box 302
Royal Oak, Michigan

Denver Fire Clay Company
3033 Blake Street
Denver 17, Colorado

W. H. Fairchild
712 Center Street
Freeland, Pennsylvania

L and L Manufacturing Company
Chester 11, Pennsylvania

Paragon Industries, Inc.
Box 10133
Dallas 7, Texas

Skutt and Sons
2618 S. E. Steele Street
Portland 2, Oregon

Unique Kilns
530 Spruce Street
Trenton, New Jersey

Wheels, too, may often be viewed and purchased from local or regional suppliers acting as distributors for the manufacturers. Sometimes it is possible to throw on a demonstrating model and this is very helpful in making a choice. Where no nearby supplier exists or information on other wheels is desired, the following are manufacturers:

American Art Clay Company
4717 West 16th Street
Indianapolis 24, Indiana

B & I Manufacturing Company
Burlington, Wisconsin

Craftools, Inc.
396 Broadway
New York 13, New York

George Fetzer Ceramics Supplies
1105 Seventeenth Avenue
Columbus, Ohio

Harvey Littleton
R.R. No. 1
Verona, Wisconsin

H. B. Klopfenstein & Sons
R.F.D. No. 2
Crestline, Ohio

Jack L. Peterson
820 Milan Avenue
South Pasadena, California

Randall Pottery
Box 774
Alfred, New York

Skutt and Sons
2618 S. E. Steele Street
Portland 2, Oregon

Davis Advertising, Inc., Worcester, Mass., U.S.A.

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